THE CASUALTY DEPARTMENT

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THE CASUALTY DEPARTMENT

BY

T. G. LOWDEN
M.A., B.M., B.Ch., F.R.C.S.

Consultant Surgeon,
Sunderland Royal Infirmary

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TO

SEVENTEEN HOUSE SURGEONS

PREFACE

THIS book produces no new concepts of medicine or surgery; nor does it intend to replace any of the standard works of minor surgery. It assumes, in fact, that the reader has a fair knowledge of the contents of at least one of these works, or a fair grounding in the subject from the teachings in his medical school. The first part of it sets forth certain modifications in this knowledge which he may make by the application of antibiotic therapy to the problems of acute superficial infections. Antibiotics have done great good to the casualty work in general hospitals, but there is an unwelcome tendency to misuse them—as placebos, as " cover " for inadequate aseptic precautions, and as alternatives to making a diagnosis. It is the view of the writer that every case, however " minor " or trivial, demands a precise assessment from the casualty officer of what he hopes to achieve by the administration of an antibiotic, and that no " new " antibiotic should be used if an " older " one may be expected to act as effectively.

It is his view also that antibiotics have not been vouchsafed to the medical profession, that its members should be excused from using their training, their knowledge, or their brains. Antibiotics are not intended to make it any *easier* for the surgeon. They are intended to make it *better* for him. These are not the same.

The second part deals with commonly occurring minor surgical conditions in which acute infections play a secondary rôle or none at all. The third part discusses certain aspects of medicine or surgery primarily concerned with the nature of the casualty appointment. The author believes that the peculiar responsibilities of this section of the hospital service have so far received inadequate attention.

These chapters are the result of a seven-years' study in the casualty department of a medium-sized, non-teaching provincial hospital. The casualty departments of such hospitals as this are responsible for the care of two million patients a year, and many hundreds of newly-qualified practitioners have been sent down to them, and left there alone for six months or a year, to find things out for themselves. This system offers a fine training ground for the development of initiative and self-reliance, and it gives practical experience of very great value both in general practice and specialist surgery. In these respects a casualty appointment ranks higher than the more popular In-Patient posts. Nevertheless, such opportunities can be more fully exploited by the house surgeon if guidance and advice resulting from the experience of previous casualty officers is readily available. If the new resident is briefed on the results which have been previously obtained and on principles which have emerged while obtaining them, his appointment will not be mainly devoted, as it is now, to learning the hard way, but to confirming previous work, and improving on it. He will start his

climb from the shoulders of his predecessor. Although lack of guidance may sometimes encourage initiative it is the lack of continuity in casualty work which has held back progress

This book may compensate, in some measure, for that lack of continuity. If the casualty officer is enabled to build upon the success of his predecessors, the effect on the community he serves will rival the profit to himself.

An industrial area with a quarter of a million inhabitants may be expected to send fifteen thousand[1] new patients to its casualty departments every year. Nearly half of these can have the period of disability reduced, if this policy of continuity is adopted, and the cumulative effect of such small improvements is enormous. While the gain to the profession is inestimable, the gain to the patient can be assessed, with some degree of accuracy, in cash. One week incapacity for a working man costs the Exchequer up to five pounds, and costs the man, in loss of earnings, about three more. Up to 20 per cent of casualty patients are working people temporarily incapacitated by their condition. Half of that percentage, on the average, are drawing sick benefit, and the other half compensation for injury. A casualty department seeing 15,000 cases a year is responsible for about £15,000 a year in National Insurance and Workman's Compensation payments. To reduce this by 5 per cent. repays the cost of maintaining the casualty officer. It can be reduced by much more than this. More still is gained in actual earning capacity, reduction of permanent deformity, and curtailment of painful disabilities Add to these the reduction which can be brought about in inconvenience, pain, domestic disorganisation, and loss of schooling affecting the remaining 80 per cent. and the part which the casualty officer plays in the activity of the community begins to show up in its proper importance.

To those intending the general practice of medicine, the variety of cases presenting at the casualty department offers an unrivalled apprenticeship. To those intending the speciality of general surgery, the opportunity to diagnose, dissect and stitch is an introductory training in technique which cannot be bettered. To anyone, the ever-changing, unpredictable host of problems affords an exercise in organising ability worthy of his most conscientious attention.

The casualty department is *not* a place where careless and unsurgical habits may be indulged. It is the purpose of this book to show that precision in operating, precision in diagnosis, and precision in mental processes are inseparable from good results.

T. G. LOWDEN.

Sunderland, 1955.

[1] This does not include fractures. The present study was carried out in an area with a separate Accident and Fracture Hospital.

ACKNOWLEDGMENTS

A CASUALTY department sees a sample of every branch of medicine and surgery. A survey of its work therefore calls for an acknowledgment of the assistance given to me by all my colleagues in and around the Sunderland Royal Infirmary. Nevertheless, any not mentioned here would themselves acknowledge the particular assistance given in certain sections by the following people—and I pay tribute to them by name because without them this book, however judged, would be much less adequate than it is, and without some of them there would have been no book at all.

Dr. Peter Inman, Consultant Dermatologist; Mr. Maurice Nairac, Consultant Ophthalmologist, Dr. James Wilson, Director of Pathological Services, and Dr. I. C. Cowan, Director of Physical Medicine—all in the Sunderland Area, have been lavish with their special knowledge, and with their ready cooperation in casualty problems over many years. Mr. R. E. Jowett, Consultant E.N.T. Surgeon, has, in addition to this, brought his administrative talents to bear, has read much of the script, and has offered valuable general advice.

Dr. A. L. Reynard, Consultant Anaesthetist to the Norfolk and Norwich Hospital, went over the chapter on anaesthesia with the same readiness and ability he showed as my war-time anaesthetist. His particularly extensive experience of casualty anaesthesia was therefore not the only reason why working together again combined business with pleasure.

Dr Robert Forbes, the secretary of the Medical Defence Union, steered me around many pitfalls in the medico-legal sections, and has been most generous of his time and patience. Any errors or uncertainties which remain are mine, not his. Mr. Cuthbert Morton, H.M. Coroner to the County Borough of Sunderland, has given the results of his wide knowledge of medical problems, and of his intimate acquaintance with the hospitals, from the legal point of view.

Mr. Douglas MacG. Jackson, in the medical research unit on burns at the Birmingham Accident Hospital, lent me diagrams and photographs, and most kindly allowed me to use material from his work; John Wright and Sons gave permission to reproduce them (Figs. 98, 101 and 102).

Miss Catherine Cramb, at the Sunderland School of Art, has given me essential assistance in the preparation of diagrams. Dr W. A. Slater, Senior Medical Officer to the branch of the Ministry of National Insurance at Newcastle-upon-Tyne, readily gave his advice in certification and National Insurance problems. Mr. Maurice Ellis, Consultant in Charge of the Casualty Department at the General Infirmary at Leeds, has been a welcome stimulus, not only because of his publications on many details of minor surgery, but from his frequent personal contacts.

Mr F. I. Herbert, Plastic Surgeon to the Newcastle-upon-Tyne Region, has taken the majority of the close-up photographs. Their excellence is its own acknowledgment, but his sustained enthusiasm and cheerfulness under my exacting requirements can never adequately be described. The application of his knowledge of plastic surgery to the minor problems of casualty work has contributed to the steady rise in standard which this book describes.

The dedication of this work is my final acknowledgment. Without the young men and women it would have been impossible. Without them, also, it would have been pointless, because it is written for them.

T. G. L.

CONTENTS

CHAPTER I

SEPSIS AND ANTIBIOTICS

UP to 20 per cent. of cases attend because of minor septic conditions. These are almost invariably due in the first instance to the staphylococcus, the streptococcus, or both. They may be treated by fomentations until they are "ripe," an incision, various antiseptic applications to the resultant cavity until it flattens out, and thence until the granulating area heals. An abscess treated in this way may be expected to take two or three weeks over its treatment, with from nine to twelve attendances and dressings. The point at which incision is used to let out the pus varies according to the habits of the surgeon. Some wait for pointing, or at least obvious, easily-elicited fluctuation. Others are not embarrassed by the possibility of failing to find pus and incise early, with varying degrees of success.

Nowadays it is considered remiss not to add injections of penicillin at some stage or other in this clinical history, and it is accepted that it is of benefit. But penicillin is often given in an irrational way, and without any definite policy. It may be abandoned before a response can be determined, or introduced at any stage in treatment from a well-meaning impulse to try something different on a case which is not going very well. A careful analysis of a large number of consecutive cases treated on these lines with penicillin, and those treated on the same lines without it, will nearly always fail to show that penicillin has shortened the period of incapacity. Casualty departments are accused of wasting more than half the penicillin they inject, and there is some justice in the accusation.

The discovery and production of antibiotics has effected more improvement in the treatment of acute inflammatory conditions than all the discoveries of the previous centuries put together. There is no doubt that penicillin itself, for instance, is highly lethal to the staphylococcus and streptococcus. Why then, should such cases take no less time to heal under penicillin?

In the early stages a subcutaneous infection by pyogenic organisms consists of a cellulitis, in which the whole of the infected area is permeated by dilated, active blood vessels. Then the centre becomes necrotic, forms pus, or a fibro-fatty slough or both. This sooner or later involves a patch of overlying skin in the necrosis, and if operation is delayed, the patch gives way a oughing skin is tough, and dams back preads far and wide in the fat before ait for the abscess to point have allowe ir incision at this stage is often followed by further necrosis of the edge of the wound. The abscess cavity

skin edges separate by more inding areas. These, though

tissue separating the viable from the necrosed tissue is rightly regarded as a natural barrier set up to prevent the spread of infection from the abscess into the general circulation.

It has already been pointed out that the majority of these infections (over 95 per cent.) are due, in the first instance, to staphylococcus, or streptococcus, or both. Cultures made from pus obtained by incision into closed abscess cavities have confirmed this statement. If, however, an open, granulating wound is established with an ulcerating surface due to loss of the overlying skin, secondary infection by coliform organisms and other gram-negative bacilli (*E*

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In this granulating tissue where small pockets abound, are places where all stages of division and development of the organism can proceed. Many of these stages, even in bacteriologically sensitive organisms, are temporarily not subject to the effect of penicillin or other antibiotics (the so-called "resting phase"), and can return to pathological activity when the local concentration of penicillin is low. In this way an established abscess cavity, especially if there is a prolific granulating lining may have persistent infection in spite of penicillin, even when "sensitive"

addition, penicillin penetrates slowly, or not

barrier into the depths of the abscess cavity itself. There is little exchange between the surrounding blood vessels and the contents of an established abscess. There is none at all between them and a slough, for the slough has entirely lost its blood supply. Many observers have reported the impression that penicillin is most effective in the early stages, or in overcoming the diffuse inflammation in the neighbourhood of abscesses, but that once pus is formed it has little effect on the length of the disease.

While it has been right, up to recently, to regard the circulation as something to be protected against infection, and granulation tissue as that which protects it, if the circulation can now be regarded as the most potent weapon against infection (because at the time of operation it has an adequate concentration of antibiotic), the granulation tissue becomes something preventing it from exerting its effect.

Topical applications cannot reach the abscess from outside, and parenteral cannot influence it adequately from the circulation. *There is no practical prospect of sterilising granulation tissue in the casualty department, either with antibiotics, or anything else.*

Apart from this, even though it might be agreed that sterile granulations will heal more ra [illegible] determining how l [illegible] it will take to collapse (that is, how big it is, what surrounding structures



FIGS. 1, 2, 3

FIG. 1 Necrosis of skin and subcutaneous tissue delays healing after all infection is overcome. Antibiotics at this stage will do nothing to hasten recovery, unless they are combined with further operation. As "cover" for a skin graft (Figs. 92 to 94) they are of value Used alone on this case they are useless. FIG. 2. A similar case of subcutaneous infection whose healing time depends on epithelialisation and not antibiotics. A skin graft will speed recovery. Antibiotics may improve the prospect of a successful skin graft Antibiotics alone are wasted. FIG. 3 The same case as Figure 2, ten days after skin graft Penicillin was given the day of operation and on the first post-operative day.

will hold it open, and so on) and how big an area is left to epithelialise when it flattens on the surface (that is, how much skin destruction or skin retraction has taken place) Even if antibiotics do hasten the sterilisation of abscess cavities, they can contribute little to recovery in the later stages, because they contribute nothing to overcoming mechanical factors, which are chiefly responsible for delay (Figs. 1-3).

Once pus forms, therefore, it is useless to rely on antibiotics to work alone. "When pus forms, let it out." Antibiotics have given no reason

whatever for forgetting this ancient precept. The majority of cases which suffer unnecessary delay in healing do so because there has been unnecessary delay in instituting surgical treatment. Blind faith in antibiotics encourages it.

T[illegible] two or thr[illegible]cillin, and a [illegible]f unnecessary injections. If it is used only at those times when experience has shown it is effective, and combined when necessary with surgical measures to ensure that its effect is exerted, it will reduce the number of attendances and shorten the period of disability by significant amounts. Futhermore, it will be possible to *demonstrate* that penicillin does in fact shorten the incapacity, because the occasions on which it is used with profit are not outweighed by many occasions when its exhibition cannot have done any good.

Bearing these considerations in mind, a policy of antibiotic therapy can be laid down for application to the majority of cases of minor sepsis. Before pus forms, while penicillin-laden blood can be carried by dilated vessels to *all parts* of the infected area, penicillin therapy combined with rest should be carried out, with the intention of aborting the infection. All are agreed that this is penicillin's most rewarding and most straightforward rôle. For this purpose it is found that a fairly rapid rise in penicillin blood level, and its maintenance for two or three days, achieves the best results. Two injections are given on the first day, and one each following day until resolution is certain. I.c.c Procaine penicillin suspension (300,000 U.) is used, twice on the first day, thence daily. If this fails to achieve resolution, and pus formation takes place, operation is necessary. Preoperative penicillin levels should be raised higher still, as will be described subsequently.

Two further points should be considered First, the blood level curves provided as illustrations of commercial advertisements, though doubtless reliable, are almost invariably the results of estimations made on hospitalised or resting patients Ambulant patients frequently disseminate their " depot " injections more quickly. It is as well to carry out check estimations in one's own department before adopting a new preparation. The second point is that if an adequate inhibitory level has been established and maintained with daily injections for three or four days, it may be relied upon to stay close to that level for as long as forty-eight hours after the last injection. Therefore, those whose lesions have resolved without operation seldom have need of further injections once it is decided that operation is not necessary. They can be dismissed.

Of those who attend early, before pus formation has taken place, approximately half may be expected to resolve entirely under this regime.

It must be admitted that very few such cases attend the casualty department, for the majority do not resort to hospital until pus has formed, and



FIG. 4
This subcutaneous abscess is suitable for eradication and primary suture. It would have been better still if it had been seen a day or two earlier. If there is any more delay primary healing is unlikely The incision was in fact healed and the inflammation entirely resolved in five days Photograph taken immediately before operation.



FIG. 5
Subcutaneous abscess arising secondary to a hair follicle infection. A case suitable for excision of slough, curettage of the abscess cavity, primary suture, and firm bandage to obliterate the cavity This case was discharged healed six days after the photograph was taken.

the opportunity is lost. For these, and for such cases as form abscesses while on conservative treatment in the department, an alternative antibiotic routine is adopted. Prompt incision is carried out under *high* penicillin levels, pus and slough are removed, and granulations are deliberately destroyed by abrasion with gauze or by the curette This allows parenteral penicillin to flood the abscess cavity, clears away the area where persistent organisms are lurking, and may well overcome the infection at once. If, in addition, the cavity can be obliterated by posture (as in an axillary abscess), by suture (as in a superficial breast abscess), or by bandaging (as in a forearm, or web space hand abscess), and the overlying skin is viable and in good condition, the incision may be sutured and primary healing confidently expected. In this way such abscesses can be healed in five to seven days, and only three or four attendances are usually necessary (Figs. 4 and 5).

It is an important principle of this method that the operation includes a meticulous exploration of every nook and cranny, the evacuation of all pus, and the removal of all dead tissue. Gentle debridement of the abscess cavity thus displayed is an integral part of the procedure. One not only *lets* pus out, one *gets* it out. These cases do not usually discharge any pus after operation. They may discharge some blood on the first dressing if obliteration of the cavity has been incomplete. Even in cases where the skin is in poor condition, and primary suture is unlikely to be successful, the use of high level penicillin therapy and eradication of the lining according to these principles does a great deal to hasten the healing time.

The dose of penicillin recommended is 600,000 U. of Procaine penicillin in aqueous suspension, and 200,000 U of aqueous penicillin, 45-60 minutes before operation. One injection of 300,000 U. Procaine penicillin suspension is given on the next day, but it is usually quite unnecessary to continue daily injections for a number of days afterwards. This routine has been adopted for the majority of operation cases, and it may be assumed that it has been carried out in those reported in this book, unless the contrary is stated.

These considerations increase the tendency to operate as soon as it is reasonably certain that pus is present. It is not necessary, with this technique, to wait for any surrounding inflammation to resolve. The penicillin injection will deal with this at the same time as providing cover for the operation. A few exceptions to this generalisation are occasionally encountered, and are usually apparent on sight, in these, twenty-four or forty-eight hours on penicillin before operation may be indicated. Little can be done in a book to guide a surgeon to a decision on the proper time; but those who wait until the skin is red, shiny, and flaccid, until soft fluctuation is present, and the abscess is coming to a peak, are losing a valuable opportunity to obtain rapid cures.

CASE HISTORIES

CASE 1. 1948. A case of axillary abscess reported eight days after the onset of symptoms. The skin was red and prominent, but not shiny. It flushed

promptly when local pressure on it was released. Fluctuation was present. Penicillin had been given by the family doctor, but it was not known how much. The abscess was incised on the first day at the clinic, and a "eusol" wick drain inserted. From pus taken at operation staphylococcus aureus was grown.

A "eusol" drain and dressing were put in on the first, second, third and fourth post-operative days. Thereafter "eusol" dressings were used at less frequent intervals. From a pus swab taken thirteen days after operation *B. proteus* was grown.

Altogether the case attended the clinic over a period of 41 days with 26 attendances. Eleven penicillin injections (penicillin in oil, 250,000 U.) were given in the clinic, in addition to those given in general practice.

CASES 2, 3, and 4 are *consecutive* cases of axillary abscess treated in 1953.

CASE 2. An axillary abscess resembling exactly the clinical features of Case 1. Irrespective of previous antibiotic therapy, the preoperative and post-operative penicillin routine (as defined on the previous page) were given. The skin over the abscess was incised (gas and oxygen anaesthesia), all pus mopped out, and the cavity, about the size of a walnut, gently curetted, with particular attention to the undersurface of the skin, which was viable but very close to the abscess boundary. The cavity was again dried out, and the incision was sutured precisely with three nylon sutures. A dry dressing was applied, after any blood accumulated during the later stages of the operation had been expressed, and the cavity was obliterated by a pad and shoulder spica.

The dressing was undisturbed but the patient attended next day for the single post-operative injection. Pus from the operation grew staphylococcus aureus, penicillin sensitive.

Five days after operation the stitches were removed, the axilla swabbed with spirit, a small dressing applied, and the patient discharged. There was still some redness of the overlying skin, but the axilla was healed and painless.

CASE 3. An axillary abscess of similar history, fluctuation and other signs of pus, but with less skin involvement as shown by the absence of a bright red vigorously flushing surface. The treatment was the same except that the incision went through a thin rind of subcutaneous tissue before reaching granulations.

On the sixth day (the third attendance) the axilla was painless and had no tenderness. The inflammation had subsided. There was however still a fluctuant swelling as large as before. Stitches were removed, and the healing incision was gently prised open and a haematoma evacuated. A dry dressing was applied, and the pad and spica replaced.

Three days later the wound was quite dry and the skin edges in apposition. A dry dressing was applied and the patient discharged.

The haematoma fluid was sterile.

CASE 4. This case attended with an abscess of similar size, but the skin over it was tense and shiny, with pus immediately under the surface at one point. The abscess ruptured when the axilla was shaved. The same routine of penicillin was given. Pus was swabbed out and the cavity curetted. This left an area of skin loss the size of a sixpence. No sutures were used, for the skin could not be brought together without tension. A dry dressing, pad and spica were applied. The wound

was inspected on the fourth post-operative day. Blood was found on the dressing, but no pus The dry dressing was repeated.

On the eighth day the wound was dry and scabbed over. The axilla was swabbed with spirit and redressed. The patient was discharged on the tenth day, with instructions to use nothing more than dry dressings and spirit toilet. He was fit for work.

These last three cases therefore had an average post-operative disability of eight days, and attendances which averaged four per patient.

CASE 5 A patient attended late one evening with the history that he had had a sebaceous cyst on the shoulder for a number of years, and it had become painful in the last six days. The cyst was at one extremity of an oval swelling the size of a tangerine orange, and the majority of the swelling was fluctuant, acutely inflamed, and extremely tender. The skin over it was red but not shiny, and firm to the touch. He was given 300,000 U. Procaine penicillin suspension, and instructed to attend the next day.

On the next day, an hour before operation, the preoperative routine injection was given An incision 1¼ inches long was made over the abscess, one end of it dividing to embrace the sebaceous cyst. The cyst was removed by sharp dissection —not enucleation—and much pus and some sebaceous material evacuated from the surrounding cavity. All granulating and necrotic tissue was smartly curetted away, and the cavity dried out. Two deep mattress sutures were passed to embrace the whole cavity. These were drawn together, and the skin edges thus roughly approximated were precisely sutured. All residual blood was expressed, and a dry dressing applied

His own doctor gave 300,000 U. Procaine penicillin suspension the next day.

The wound was redressed on the fourth day. There was a patch of pus on the dressing the size of a penny. Stitches were removed on the sixth day. There was still some residual redness and tenderness, but the wound did not discharge and the incision was sound. He was instructed to attend on the tenth day but did not do so. His own doctor reported that he had had no trouble and did not regard further attendance as necessary.

Resistance to individual antibiotics is increasing, and it is probable that during the coming years a pattern of behaviour will reveal itself, in which the development of new antibiotics is expected to keep at least one move ahead of the development of resistance on the part of the organisms in competition. This pattern affects the work in a casualty department, and unless the department keeps well abreast of the developments any routine is in danger of becoming outdated, perhaps quite suddenly. If an organism with high antibiotic resistance is present, there is the possibility of rapid dissemination of infection through the patient, when the protective granulation barrier is removed. This must always be kept in mind. It has not occurred, so far, in any of the cases treated.

It can already be inferred from the descriptions which have been given that a principle running through all the work is to avoid the establishment of granulating surfaces wherever possible, and to obliterate them when they are found. Secondary infection is one of the commonest causes of prolonged

incapacit[illegible] ...ting surfaces invite secondary infection. Further support f[illegible] resistance.

The actual figures vary from hospital to hospital, but surveys taken in different parts of certain hospitals show that penicillin resistant staphylococci are found in wards, operating theatres, and out-patient departments (such as E.N.T.) where many chronic dressings are done as a routine. In the casualty department *provided there are very few chronic dressings*, penicillin resistant staphylococci hardly ever occur. Not only is it true that over 95 per cent. of the sepsis coming to the department is due to staphylococcus and streptococcus, but it can also be shown that 95 per cent. of these staphylococci, (and all the streptococci) are penicillin sensitive. Such culture reports reflect the situation *outside* the hospital. If a large number of chronic granulating wounds attend, the number of resistant organisms rises, and tends to approximate to the incidence in the wards and the rest of the hospital. Secondary infections, therefore, are not only by gram negative organisms which never did respond to penicillin, but also by staphylococci which may have acquired resistance, or may be variants with natural resistance which are more able to survive the " antibiotic atmosphere " of a modern hospital.

(Penicillin resistance develops by both these mechanisms, though in any particular case it may be difficult to establish which has occurred. It is perhaps unnecessary to know from the practical point of view, though of great importance when considering the larger issues of the struggle between therapy and a bacterial population always seeking new methods to counteract it.)

Some departments, by the nature of their work, must accept the difficulties of antibiotic resistance, and many of them are already adopting the routine use of newer and more expensive antibiotics; but the casualty department, by maintaining a rapid turnover, by dealing mainly with infections contracted outside the hospitals, and by regarding granulating wounds with grave distrust, can keep itself comparatively free, and should do so. Primary suture does much to make it possible. Infrequent dry dressings, with proper surgical ritual, does much more (p. 192).

Penicillin resistance is relative, not absolute, and when a laboratory returns a report to the effect that an organism is sensitive or resistant some idea must be formed as to what this really means. In most laboratories the standards are approximately the same, and a penicillin resistance is accepted where it is about four times the resistance of the Oxford standard staphylococcus. On this rating many organisms usually reported as resistant cannot in fact withstand the dosage recommended, and the clinical response to treatment may justify the use of penicillin when a report from the laboratory arriving one or two days later might be misinterpreted as implying that the penicillin has been useless. The standard Oxford staphylococcus is inhibited by 0·04 U. penicillin per c.c., and the dosage given above will in many cases

create, for the operative period at least, a blood serum level between 0·4 and 0·5 U. per c.c.

Although these standards are usually adhered to, different bacteriologists adopt different techniques and there is always liable to be some variation. The bacteriologist's report is not intended as a result of infallible processes carried out with mathematical precision, nor as an *obiter dictum* to be entirely neglected, but as another of the facets in a many-sided picture, and one to which the clinician attributes its proper importance, but no more.

As long as the organisation of the department can be relied upon to keep gram negative organisms and insensitive staphylococci away, penicillin will remain the mainstay of the treatment of minor sepsis.

It is advisable to keep closely in touch with the bacteriological situation by taking swabs. It is manifestly impossible to swab every case, and it is unnecessary also. A series of twenty or thirty from fresh, operative pus, taken about once a year, will give a fair indication of what is happening in the world outside. *This "bacteriological survey" has been made every year for* the last four years, and as yet no appreciable increase in penicillin resistance has been detected (Appendix II) On the other hand, any granulating wounds should be cultured if they do not heal quickly to find out what organisms are common inhabitants of the department. When it is suspected that an infection is due to organisms inoculated in hospital—secondary infection of clean wounds (p 2), or primary infections in the hospital staff—one should be particularly careful; though even in these (p. 11) the majority will respond to large doses, given at the crucial time, and combined with adequate surgery.

When an appreciable incidence of penicillin resistant organisms is found *in the infections as they first come up for treatment, it will be necessary to* change the details, and perhaps to change the antibiotic. That time is not yet, and may be many years ahead There is no evidence, up to now, that penicillin resistance is increasing in staphylococci occurring amongst the population as a whole The routine use of other antibiotics to replace penicillin has disadvantages, and should be postponed for as long as possible. When the change does occur, it will make little difference to the principles set forth in this chapter. Names, dosages, and methods of administration may change, but there is nothing to indicate that the object of using surgery for the dual purpose of getting pus out of the abscess, and *letting the antibiotic in*, will be abandoned. The ability to obtain primary healing in sepsis, instead of waiting for healing by second intention, is not new in surgery, but the planned use of antibiotics has made it much more certain of success Its application to large numbers of "minor" cases is especially valuable.

Enough has been written also, to emphasise that "penicillin resistance" cannot lightly be invoked as an excuse for bad results. If it is ensured that penicillin is given at a stage in the disease when it can be effective, and

associated where necessary with measures to ensure that it gets from where it is injected to where it is needed, its value will become brilliantly manifest.

Case Histories

Case 1. A nurse reported a three days' history of infection of the digital pulp space. She had already had three injections of Procaine penicillin suspension, each of 600,000 U., together with rest and elevation. The last of these injections had been made immediately before reporting to the clinic. The lateral part of the pulp space showed a localised abscess with a small area of cuticle raised by pus. The penicillin level was further raised by 200,000 U. aqueous penicillin and an hour later the cuticle was removed, pus evacuated, and the cavity smartly abraded with dry gauze. The operation was carried out with a tourniquet. A firm dry dressing was applied, and the tourniquet released.

300,000 U. Procaine penicillin suspension were given the following morning.

On the fourth post-operative day the dressing was removed. The wound was dry and scabbed over. A dry dressing was repeated and the nurse returned to duty with instructions to keep the bandage dry for three more days. A staphylococcus, "penicillin resistant," was grown from the operative pus.

Case 2. A youth was sent up by his own doctor with a history that he had cut the end of his index finger five weeks previously. The cut had failed to heal in spite of two prolonged courses of penicillin. The finger showed an ulcer one-third of an inch across, one edge involving the nail bed. The patient was a butcher's assistant, and it was considered that an unusual penicillin resistant organism might be responsible

The pre-operative and post-operative penicillin routine was given. A tourniquet was applied. A small area of nail overlying the ulcer, and a further portion of nail raised by a paronychial spread, were excised. The ulcer was smartly abraded with dry gauze. When the granulations were removed it became apparent that the edges could be apposed with two stitches, and that this would restore the original linear cut. The ulcer had been entirely due to skin retraction. A firm dry dressing was applied and the tourniquet removed. The lesion was dry and almost healed in seven days, the stitches were taken out, and he was discharged with a sound scar on the twelfth post-operative day. Penicillin sensitive staphylococcus was grown from the swab taken at operation.

Bacteriological resistance, as in the first of these cases, and apparent clinical resistance, as in the second, do not necessarily indicate that penicillin will be useless, provided that it is combined with proper surgical measures.

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CHAPTER II

COMMON SEPTIC CONDITIONS

BOILS AND CARBUNCLES. Although the development of inflammatory processes around the hair follicles follows the same pattern as inflammatory processes in the subcutaneous tissue, there is a stronger tendency to form hard fibro-fatty slough—the " core "—and often a more rapid march in the earliest stage, so that the period during which antibiotics can obtain complete resolution without gross tissue destruction is short. It is usually passed over before the patient reports to a hospital for treatment. Nearly all cases are already forming slough and pus when they are first seen. Antibiotics are unlikely to sterilise the infection at this stage.

The time taken for healing therefore depends on the ability to throw off the slough, discharge the surrounding pus, and to collapse and epithelialise the cavity. Hence it is common to hear that penicillin cannot shorten the disability—which is often true—or that boils are due to infection by penicillin resistant organisms—which is not. (Swabs taken from twenty consecutive cases of furuncle when the pus was first available showed nineteen to be due to penicillin sensitive staphylococcus, and the twentieth had a " moderate degree " of resistance.) Penicillin cannot speed the histological processes which separate off the slough. Nevertheless, penicillin is useful in the early stages, and for three reasons. Firstly, some patients have had sufficient experience of boils to recognise the more deeply situated, constant, aching pain which distinguishes the early stages of a boil from the early stages of a papule. If they report in time, penicillin will abort the infection. Secondly, boils are notorious for their habit of coming in crops. Even though the case reports when the boil is too well established to be aborted, penicillin may prevent the establishment of further infection in adjacent hair follicles. Thirdly, penicillin, again in the early stages, encourages resolution of the surrounding inflammation and swelling, helps to ease the pain, and thereby reduces the actual volume of tissue doomed to necrosis, leaving a smaller cavity after discharge and leading to more rapid convalescence. It may, in fact, shorten the disability by a little though it is difficult to prove it statistically. Once the boil is well localised prolonged penicillin therapy is wasted.

Once the boil is localised, also, it is doubtful if operation (by the " cruciate incision ") helps very much, and to operate before it is localised is useless. If the slough is precisely excised under penicillin cover, the resulting wound will take five or six days to heal. If some of the slough is left, or sloughing extends after excision, which is not uncommon, this must separate and takes as long as the complete slough would have done. If the

slough is discharged spontaneously without operation the resulting cavity usually collapses promptly and heals as quickly as an incision.

Penicillin in the early stages, conservative treatment with local rest, and a dry, infrequent dressing when discharge occurs, should result in an average incapacity of seven or eight days.

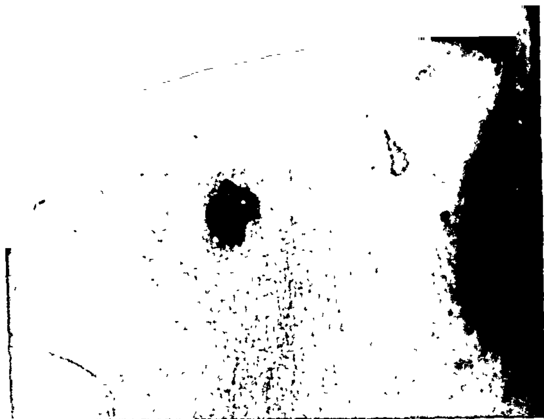


FIG. 6

A carbuncle of shoulder treated by eradication under high penicillin dosage and immediate Reverdin graft. Photograph taken on the eighth post-operative day.

If infection spreads into the subcutaneous tissues it may lead to the formation of an underlying subcutaneous abscess. A subcutaneous abscess profits by operation in most cases, and therefore a boil which has spread beyond its proper limits must be treated for the more extensive condition. In these cases the slough can be removed as the incision is made, and primary suture of the remaining viable skin edges may be expected to be successful, provided it can be carried out without tension (Fig. 5). The axilla is a common place for this complication to occur, and it occasionally arises from hair follicle infections on the dorsum of the fingers, the hand (p. 34) and the forearm.

The large, spreading carbuncle is much less common than it used to be, and such a case is a candidate for In-Patient treatment. Conservative treatment with antibiotics, allowing the lesions to discharge spontaneously, is apt to be of long duration. Curettage and excision of slough may lead to an

extensive operation and considerable blood loss. The granulating area which results will require skin grafting. On all these counts such cases should be admitted to hospital.



FIG. 7
A carbuncle of forearm treated by eradication and primary suture under high penicillin dosage Photograph shows a dry scabbed lesion after removal of sutures on the fourth post-operative day.

Smaller carbuncles, or multi-focal boils, can be treated successfully as Out-Patients along the conservative lines followed with boils, but in these there is perhaps a stronger tendency to combine surgical intervention with antibiotic therapy. The skin loss in a carbuncle is considerable and even though infection may be swiftly overcome the granulating area may persist for long periods and require many attendances for dressings. It cannot be emphasised too strongly that there is much to gain by an attempt at early skin grafting, or even, in suitable cases, by suture if it can be carried out without tension. Such enterprise is often rewarded by astonishing success.

CASE HISTORIES

CASE 1. A woman of fifty-two attended with a fourteen days' history of a carbuncle at the tip of the shoulder. Four foci were present causing a sloughing granulating ulcer one inch in diameter. Penicillin routine as already detailed was adopted. The carbuncle was firmly curetted down to its fibrous base Five (Reverdin) pinch grafts were arranged in it, and applied by a petroleum jelly gauze, paraffin emulsion wool, and elastoplast dressing. The dressing was removed on the fifth day. The wound was dry. She attended once again, three days later, when the photograph was taken and the lesion given its final dressing (Fig 6)

CASE 2. A carbuncle of the forearm two-thirds of an inch in diameter was curetted and sutured without tension under penicillin routine. The photograph (Fig. 7) shows it appearance after removal of sutures on the fourth day. The patient was discharged with a dry dressing on this, his second attendance.



FIG. 8
Carbuncle on the ulnar border of the wrist, measuring one inch in diameter The carbuncle was carefully curetted down to its base in which the tendon sheath of flexor carpi ulnaris was exposed. Thiersch grafts were applied immediately. Photograph was taken on the fifth post-operative day, on removal of operation dressing.

CASE 3. A deep carbuncle of the forearm. Eradication produced a clean cavity an inch in diameter, deep enough to expose the flexor carpi ulnaris at the bottom. An immediate split skin graft took entirely and the lesion was dry in five days. In a fortnight the cavity was obliterated and the small skin-grafted area was then almost indistinguishable from the surrounding surface (Fig. 8).

It is still not uncommon for recurrent furunculosis and carbuncles to present the first indications of diabetes mellitus, especially in the middle-aged. More than a trace of reducing agent persisting in the urine during convalescence merits further investigation. The specimen should be obtained in the department, as early morning specimens in the diabetic are sometimes sugar-free.

Axillary Abscesses.—The illustrative case histories used in the last chapter have included a number of axillary abscesses, and therefore a description of their treatment has already been written. The majority of axillary abscesses are secondary to infection of hair follicles or of apocrine glands, but the occasional case of suppurative lymphadenitis can be treated in exactly the same way. Though it is common for glands to become enlarged secondary to forearm and hand sepsis, it is now unusual for this to proceed to abscess formation, mainly because antibiotic therapy for the primary condition (even if it has had little effect on it) combats secondary lymphadenitis while the blood supply to the gland is unimpaired. Two thousand five hundred consecutive cases of septic hand have been treated without suppurative lymphadenitis. During this time there have been only three cases of acute axillary abscess undoubtedly due to breaking down lymph glands. In all three the primary portal of entry was never found.

The recurrent axillary inflammation, where a series of abscesses, and a course of minor operations, afflicts the patient over a number of months, is due to repeated reinfection of hair follicles or apocrine glands, often by the discharge from previous operations or lesions. A procedure whereby the discharge is scanty and sterile from the day of operation does much to cut short the course of the disease. Tuition on axillary toilet, with emphasis on the avoidance of maceration of the skin (by the use of spirit swabs and dusting powder) is perhaps as important.

Some cases produce a dilemma for the surgeon. In these there is much inflammation, with a mass approaching the size of an orange. Expectant treatment results in the production of a little superficial abscess at one point, with no diminution of the underlying inflammation. If one waits until the surrounding inflammation has resolved the abscess will rupture, and secondary infection may supervene. If one operates on the abscess, and lets out the pus, the incision will heal in the presence of the inflammation and other abscesses will occur later. Sometimes it must be accepted that more than one operation will be necessary. Many cases, however, will resolve if the whole of the inflammatory mass can be broken down with the finger, or the curette, or both; and suture, under the protection of antibiotics, can be safely contemplated,

even in these. The subcutaneous tissue appears to be honeycombed with pockets of breaking down inflammatory tissue, and the conversion of all these into one cavity paves the way for adequate obliteration and resolution (Figs. 9 and 10)



FIG 9



FIG. 10

FIG 9 A large axillary abscess, with much surrounding inflammation. The condition after removal of one deep suture on the fourth post-operative day The suture was inserted to obliterate the cavity left after curettage of the abscess. The incision was discharging a little serous fluid

FIG. 10 Same case as Figure 9 On the eleventh post-operative day the incision was healed and the case ready to be dismissed

A series of thirty-six axillary abscesses, treated by eradication and primary suture averaged $6\frac{1}{2}$ days' treatment. A similar unselected series of cases, treated by simple incision and repeated dressings (with or without a "wick" or "pack") averaged sixteen days.

A very rare but serious type of axillary abscess occurs in which the pus tracks upwards towards the apex of the axilla under the pectoralis major. The depth of the cavity at operation is astonishing, and it becomes inadvisable to use the curette at such a distance. There is usually little in the physical signs to give warning of its extent. Sometimes, however, tenderness and even swelling in the subclavicular region may be present, and marked constitutional disturbance is almost constant. Fixation on an abduction splint is the most effective additional aid to resolution, and In-Patient treatment must be considered.

Subacute or chronic axillary abscesses are occasionally tuberculous. A chronic skin lesion on the hand or forearm may be the cause, or more commonly a focus secondary to mediastinal infection, running round the chest

wall and localising in the axilla. Lung parenchymal infection, or infection of a rib, must also be considered. If the diagnosis is made before operation such cases should be referred to the appropriate department, either surgical or tuberculosis. If, as occurs occasionally, the abscess is opened under the impression that it is an acute inflammatory condition, it is usually possible to curette out all caseous material, remove a fleshy part of the gland, or part of the wall of the abscess for histological examination, and suture the wound. No case of tuberculous axillary adenitis should be discharged without taking steps to identify a primary focus, although such a focus is not, of course, always found.

Cervical Abscess.—The treatment of tuberculous lymphadenitis in the neck still gives rise to considerable controversy, but casualty departments, whatever treatment they favour, would be well advised to refrain from it. It is our considered view that the "cold abscess" of the neck should be subjected to specialised and if necessary prolonged care, and the quickest way to ensure this is to refer the case or arrange for its admission as soon as it is diagnosed.

If a diagnosis is not made before operation, as occasionally occurs with secondary infection of a tuberculous abscess, the case should be treated in the first instance for its secondary infection, and arrangements made for further treatment as soon as possible.

Curettage and primary suture of acute cervical abscesses are often as successful as elsewhere, but there is difficulty in obtaining obliteration of the cavity. *Deep* suture is strongly contraindicated, as it is impossible even to guess what the needle will pierce in the depths of the wound. Firm bandaging is equally impossible. Consequently an extra attendance is required in anticipation of haematoma formation. If a haematoma forms, its evacuation on the third or fourth day usually results in rapid healing. It is seldom followed by the secondary infection one might expect. On the other hand, much delay in instituting surgical treatment results in a firm lining developing in the wall of the abscess which prevents its collapse after eradication.

CASE HISTORY (of a failure)

A child of four attended the casualty department with submental adenitis An attack of impetigo of the lower lip and chin had healed a week previously. The enlarged glands were treated expectantly for eight days with injections of penicillin. At the end of this time a rather belated diagnosis of abscess formation was made The abscess was incised, and thin pus under tension was evacuated. It grew haemolytic streptococci. The cavity was curetted and the incision sutured. It was impossible to obliterate the cavity by reason of its situation, and it did not collapse spontaneously. Penicillin was given in the usual pre-operative routine, and 300,000 U. the day after.

A week later the child had to be admitted to hospital with a recurrence. Thin serous discharge came from the cavity, which grew haemolytic streptococci again.

High penicillin dosage was given, the wound reopened and extended. The cavity was firm-walled, and lined with granulations, which were curetted a second time. The cavity was not sutured at the second operation, and penicillin (300,000 U. daily) was continued for five days The cavity healed by slow obliteration and the total length of treatment was 23 days.



FIG 11
A case of submandibular abscess with much surrounding inflammation Eight days before the photograph was taken the abscess was explored and eradicated The incision was sutured Pre-operative penicillin was given as in the other cases, but because of the extensive induration 300,000 U Procaine penicillin suspension were continued daily for four days afterwards. The head and neck were immobilised between sandbags Primary healing occurred, with a minimum of scarring, and within fourteen days all swelling had disappeared The incision was cited over the submaxillary triangle, low down The abscess cavity was much higher up, mainly superficial to the bone, but it was approached from below to avoid a scar in the more obvious place

The cause of the failure was undue prolongation of pre-operative penicillin treatment. A rigid cavity was produced before the infection was overcome, and it was in a situation where mechanical obliteration was impossible. The organisms isolated were penicillin sensitive.

Cervical abscesses are unfortunately usually pointing or ruptured when they first attend, and this is responsible for the fact that only a minority have sound enough overlying skin for successful suture Even in the rest, however, the eradication of all septic granulations as well as the evacuation of pus releases the patient from a series of pus-soaked dressings and speeds up the healing process. Two or three post-operative dressings are usually sufficient.

Abscesses in the submandibular and submental areas borrow skin from the face, often to a considerable extent. Incisions made apparently below the lower border of the mandible are sometimes found to have " ridden up " on to the face when the swelling resolves. A scar one expected to be unobtrusively tucked away out of sight thus becomes visible, in a disfiguring manner If the skin has already broken down, the abscess must be drained at this point, for a scar there is inevitable. If, however, the whole of the overlying skin is viable, it may be worth while to site the incision lower than the apex of the swelling, and to approach the abscess somewhat inferiorly, even through uninfected tissue, to avoid this embarrassment (Fig. 11).

Infection in the neck often illustrates the well-established axiom that the first essential in the treatment of inflammation is rest—local rest, and general as well if necessary. The neck is never still. It may be necessary to keep it still, in some cases by resort to putting the whole head in plaster (p. 95). It is rare for *acute* cervical infections to demand such extreme measures as this,

though lesser measures play an important part. The use of a felt collar, for instance, over the wound dressing may limit movements effectively.

CASE HISTORY

A middle-aged woman was referred to the casualty department by the Consultant Dental Surgeon. She had extensive soft painful enlargement of the deep cervical chain on the left side, following tooth extraction. The Dental Surgeon reported healed tooth sockets and no residual cause of infection in the jaw. She had been given two courses of penicillin and the condition showed no sign of improvement after three weeks' treatment.

She was admitted to hospital and treated with further penicillin, followed by a course of chloramphenicol. On the surgeon's round five days later there was still no sign of improvement.

The surgeon asked her how she was. Her reply occupied over two minutes.

" Sister, does this patient ever stop talking? "

" No, hardly ever while she is awake, and she talks in her sleep."

" Then, how can her jaw ever be at rest, or her glands either? "

She was commanded to lie down. Her neck was put between sandbags, and a third sandbag placed over her forehead. She was forbidden to speak except for urgent requests. She acquiesced with unexpected good humour. Her glands began to subside within two days, and had resolved entirely at the end of a further week's treatment. No more antibiotics were given.

Olecranon and Prepatellar Bursitis.—These bursae are usually infected by direct spread from surrounding subcutaneous infections, though it is believed that a lymphatic convection from distal infection may be the cause of some. A small crack in the skin overlying the bursa is a common portal of entry, and there is a strong occupational predisposition (" beat " knee and " beat " elbow of the mining communities). The orthodox method of treatment is to incise and drain with soft rubber tissue. In occasional cases, where the bursitis is well localised, primary healing may be obtained by eradication of the granulating lining of the bursa (Figs. 12 and 13). Prepatellar bursa is often sufficiently incapacitating to justify admission to hospital, but many can avoid this if the rest obtained by splintage is acknowledged to be an essential part of conservative treatment.

CASE HISTORY (Figs. 12 and 13)

Two weeks before attendance the patient cut his little finger. It was treated at home, became septic, and healed by second intention. A week later he developed cellulitis of the elbow region with lymphangitis of the upper arm. His family doctor, a general surgeon of great experience, treated him with penicillin and immobilisation until the condition had entirely resolved, except for a suppurative effusion into the olecranon bursa. He determined that surgical drainage was necessary and at this stage referred the case to the casualty department.

On the first day of attendance the patient was given routine high penicillin dosage, and the abscess incised. The lining of the bursa was granulating. After evacuation of pus the cavity was systematically curetted. The incision was sutured.

All blood was evacuated and a firm bandage applied. One further injection of penicillin was given on the first post-operative day. On the seventh day the dressing was removed. There was some redness of the skin but the incision was healed and there was no effusion. The stitches were removed and the patient discharged with a dry dressing A week later the family doctor confirmed that recovery had been complete.



FIG. 12
Suppurative olecranon bursitis before operation.



FIG. 13
Same case as Figure 12. The operation dressing was removed seven days after evacuation of the abscess, curettage of the granulating bursa, and primary suture of the incision. The stitches were then removed and the case was dismissed.

Simple Perianal and Ischiorectal Abscess.—These conditions must be *very carefully distinguished from fistula-in-ano. The latter gives rise to re-*current abscesses near the anus, or a chronic sinus, and there is often a history of previous incisions. In these there is a strong suspicion of an internal communication, and they require meticulous exploration and often prolonged convalescence. They should be treated as In-Patients.

They must be further distinguished from a pilo-nidal abscess. It may be justifiable to incise a pilo-nidal abscess in its acute condition while the patient is an Out-Patient, but it should be announced that this is probably only a short-term relief and that a cure will call for a more extensive operation and a longer convalescence.



FIG. 14
A perianal abscess of ten days' duration, immediately before operation. This case healed in five days.

A small, well localised unilateral perianal or ischiorectal abscess can be incised and eradicated by curettage. In such cases it is not necessary to excise areas of skin intending that they take a long time to heal. Heavy pre-operative penicillin dosage, and a pre-operative injection of sulphonamide, will give enough protection for a high proportion to heal after primary suture. Obliteration of the cavity is obtained by demanding that the patient sits on his wound naturally from the time of his operation, and because there is little pain after removal of inflammatory tissue he will usually agree to do so. A small dry dressing over the sutured incision may require renewal after bowel action. It can be applied in the home. When the case is seen after delay, and the skin is involved, suture is unlikely to be successful, but even these cases heal much more quickly if the cavity is curetted after pus has been evacuated.

Case History (Fig. 14)

A man of twenty-five attended with a perianal abscess to the lateral side, presenting somewhat posteriorly. The inguinal glands were enlarged and tender but not suppurating. He had been given three injections of penicillin by his doctor, but the dose was not known.

To the routine pre-operative penicillin were added two grams soluble sulphadiazine intramuscularly The day after operation he received 300,000 U. Procaine



Fig. 15

A large
Lactatioı
casualty
weeks pr
not be expected to heal by first intention The necrosing skin was excised, the abscess eradicated and its limits gently curetted The cavity was obliterated by deep suture Pre-operative high penicillin dosage was used, and 300,000 U. Procaine penicillin suspension continued daily until the bacteriologist reported that penicillin insensitive staphylococcus aureus had been grown from the pus obtained at operation. Chloramphenicol (500 mg. six-hourly for five days) was then given A discharging area the size of a penny persisted for two and a half weeks Length of treatment, eighteen days. Attendances nine.

penicillin suspension. The abscess was incised and its cavity carefully curetted. The incision was closed with two sutures. He was instructed to sit up on a firm chair during his convalescence. Five days later the stitches were removed. The incision was dry and all lymphadenitis was resolved. This case was one of the first ten cases treated by primary suture. The average incapacity for the ten was four days.[1]

Breast Abscess.—The advent of penicillin led to a short-lived vogue for treating breast abscesses by closed irrigation and aspiration. It was short-

[1] Ellis (p. 28) in a personal communication, informs us he has treated over 300 cases by primary suture. Aseptic healing was obtained in 90 per cent.

lived because it is essential for prompt healing that loculation be dealt with surgically. Incision, evacuation of pus, conversion of all ramifications into a single cavity, eradication of granulations and slough, follow the course recommended for other abscesses. Obliteration of the cavity by deep sutures drawn taut (but not so tight as to interfere with circulation in the skin edges) finds its most successful role in the treatment of breast abscess. Large dressings are useful more to secure rest and fixation to the whole breast than



FIG. 16

Bilateral breast abscesses, eleven days after eradication and primary suture. Lactation was suppressed and the infant weaned before the case attended. Penicillin sensitive staphylococcus aureus was isolated from pus obtained at operation. Penicillin dosage given as in the previous case. No other antibiotics used.

because there is much post-operative discharge. There is very little. Some cases heal by first intention. Many (Fig. 15) come too late for skin apposition to be obtained, and operation replaces the abscess by a small discharging area which takes about ten days to heal.

Many factors influence the prognosis in a breast abscess, and influence the decision whether to complete treatment in the casualty department or to recommend admission to hospital.

1. The abscess differs from subcutaneous abscesses in that infection starts in the ducts, ramifies in them and spreads to the areolar tissue later. The cavity of an established abscess is therefore much more irregular, and inflammatory processes of all stages of maturity exist at the *same time*. Exploration must therefore be under direct vision. After incision is made any ramification from which pus can be expressed must be followed to its limit. The incision can be as large as the operation indicates because it will heal quickly after suture (Fig. 16). Sloughing strands between loculi must be excised. The operation may consequently be a lengthy one.

2. Lactation may have been entirely or partly suppressed, or may still be in full progress. There is much difference of opinion on the course one

should pursue. It is a well-established belief, both in medical and lay circles, that lactation should be inhibited. Many abscesses are *provoked* by removing the infant from the breast at the first sign of a cracked nipple, for the resultant engorgement makes it ripe for spread of infection. If breast feeding is continued (with a nipple shield) and penicillin is given, the infection will often subside.

If the infection is established, and an abscess is formed, any patient willing to continue feeding should be encouraged to do so. The sound side can continue to nourish the infant. The operation side should be expressed or the evacuator used upon it. It is quite possible that this milk is uninfected also, but the patient cannot be persuaded that this is so. Nor should she if the idea is distasteful to her.

Attempts to suppress lactation before the patient is referred to the casualty department are often half-hearted and unsuccessful. The infant has already been removed from the breast for a number of days and is well established on a bottle regime. The mother has painful engorged breasts, in one or both of which is much induration, a little sepsis, and much milk. Evacuation of pus at operation may be followed by milky discharge which prevents rapid healing. These cases should have an effective suppression carried out promptly[2] and it should be done before operation, if the delay does not reduce the chances of success for suture.

When the abscess occurs a number of months after delivery the indication to continue breast feeding is seldom evident. Many abscesses occur when breast feeding has been unduly prolonged. Undue prolongation may occur from the mistaken belief that breast feeding militates against conception, and it is used amongst the ignorant as a form of birth control. There should be no hesitation in removing nine-months-old infants and yearlings from the breast, but lactation may be tardy in its departure in some cases and withdrawal may have to be gradual.

3. The use of penicillin in general practice has done much to reduce the incidence of cases seeking hospital treatment. Of those who attend hospital, very few are of the type which used to be so common, in which the whole breast is replaced by a bag of pus, and in which constitutional upset is marked. Many are localised or sector abscesses, and are suitable for Out-Patient treatment. The knowledge that admission is not necessary is usually as acceptable to the patient as it is to the duty surgeon (Appendix IV).

The *prolonged* use of penicillin in breast abscesses after pus has formed, leads to increase in the surrounding induration, and to the production of a hard, painful, congested shell around the abscess cavity itself. It bleeds profusely when incised, delays healing and prolongs incapacity, often by many weeks. It is due to a failure to observe the essential precepts in the

[2] Fashions vary. The present routine in the author's clinic is Ethinyl oestradiol, 0·05 mgm four times on the first, three times on the second, and twice on each of the third and fourth days.

surgery of inflammatory conditions. When pus is formed, no antibiotic is likely to dissipate it. The prolongation of penicillin therapy beyond its proper period is responsible for many of the complications of acute abscesses, but perhaps nowhere so commonly as in the breast, because the breast is peculiarly prone to induration anyway, and because the presence of pus is more difficult to detect in the breast than in many other situations.



Fig. 17
A large abscess in the lactating breast, of at least fourteen days' duration. The skin is involved and part of it is non-viable.

This is not an argument that the use of penicillin in this condition should be abandoned. It emphasises that these, like other infections, will respond to penicillin *promptly* if they will respond at all. If the response is incomplete or non-existent the most probable reason is that the case is in need of operation, not of further injections of the same antibiotic, or a new course of another one.

4. The general remarks made on the low incidence of penicillin resistant organisms in inflammatory conditions seen in the casualty department require qualification, in so far as breast abscess is concerned. It was pointed out that infections acquired outside the hospital are almost always penicillin sensitive. Breast infection is not always acquired outside hospital. It may be inoculated in the maternity department where the infant is delivered, incubated in the second and third week when the patient is returned home, and presented as a "new" case to the casualty department of the general hospital. In spite of its Out-Patient "status" it is therefore a ward infection and one's attitude to it must be modified accordingly. The majority may still be operated upon using penicillin as the operative cover, but the persistence of infection may indicate the use of chloramphenicol or another antibiotic when the swab taken at operation is reported upon subsequently (Appendix IV).



FIG 18
The abscess is widely opened, pus is mopped out but not expressed, and any non-viable part of the overlying skin is excised



FIG. 19
Pressure from the periphery of the abscess reveals outlying pockets of pus These are opened with sinus forceps and cleaned out with gauze.



FIG. 20
Excision of sloughing fibrous and fatty tissue transforms the multiple loculations into one cavity. The lining of the cavity is gently curetted.



FIG. 21
Deep mattress sutures obliterate the cavity. The loops are held away from the skin by gauze rolls to prevent cutting-in.



Fig. 22



Fig. 23

Fig. 22. The mattress sutures are tied, and the skin incision sutured.
Fig. 23. Seven days later the stitches are removed. This case discharged a little thin serous fluid for a fortnight after operation. There was no pus on any post-operative dressing.



Fig. 24

Abscess in the non-lactating breast. It is superficial and close to the nipple. This case was photographed five days after operation. The scar from the deep suture is seen, because the gauze rolls were omitted. The two skin sutures were removed on the seventh day and the case dismissed.

CASE HISTORY

A woman had been delivered at home a month previously and had had pain and swelling in the right breast for a fortnight. Her family doctor had given her daily penicillin injections for the first seven days of the inflammation, had taken the infant from the breast and suppressed lactation with stilboestrol. On attendance it was apparent that pus was close to the surface (Fig. 17). She was given routine high pre-operative penicillin, and the breast was incised. Non-viable skin was excised from the wound edges, and all ramifications of the abscess explored. Dead tissue was excised, and the lining of the abscess curetted. The cavity was obliterated by vertical mattress sutures and the skin closed accurately (Figs. 18 to 22). There was some surrounding inflammation, and possibly small abscess cavities remained in the peripheral acini. Daily penicillin injections (300,000 U. Procaine penicillin suspension) were given at home for a week after operation. The incision was re-dressed on the third day. There was blood-stained discharge, but no pus. Stitches were removed on the seventh (Fig. 23). A little serous discharge persisted for another week. The patient was dismissed on the seventeenth day, when the incision was quite healed There was still some surrounding induration, but this was resolving rapidly. She attended five times after operation for dressings.

Abscesses in the non-lactating breast are usually superficial, and close to the nipple (Fig. 24). Neo-natal and puberty mastitis are very occasional causes Others arise in ascending duct infections, and this can occur in the male. Others are subcutaneous abscesses not involving the breast tissue—or boils. Their treatment does not call for special comment.

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CHAPTER III

THE SEPTIC HAND

THE most authoritative work in recent years devoted to infections of the hand is the book by Kanavel. Standard incisions are recommended for standard spatial infections which are described on an anatomical basis. A policy of early incision is advocated, from the conception that increasing pressure in these infected spaces causes necrosis of tissue by cutting off its vascular supply—leading to extension along recognised channels in the soft tissue, and extension to adjacent tendons, bones and joints. One incised therefore, according to Kanavel, not necessarily to let pus out, but to decompress the anatomical spaces, what time the infection was overcome by other measures.

A revolutionary paper, published in 1948 by Pilcher and others, announced a revised conception of treatment, based on the fact that penicillin and rest to the whole hand may confidently be relied upon to obtain decompression of the infected space without incision, and this has allowed the indication for surgery to fall back upon the principle applying to suppuration elsewhere—where (and only *if*) there is pus, let it out. This paper has had such a fundamental influence on the treatment of the septic hand that the casualty officer who is unaware of the views therein is incompletely equipped for his appointment.

It is not intended to repeat the descriptions and aids to diagnosis which have already been made in these and other works, but to assume that they have been assimilated. It may be added, however, that the argument advanced in Chapter I of this book regards surgery as an opportunity to let the antibiotic into the abscess at the same time. This does *not* alter the indication for operation, although it adds detail to the operative technique. It is also emphasised that incision must be before there is necrosis of the skin, because loss of skin materially delays healing. By keeping these principles in mind the time at which incision should be made becomes clear-cut, and the site for the incision is defined as the place where the pus most nearly approaches the surface. Operation is carried out with a tourniquet, and a precise exploration of every ramification of the abscess becomes an essential part of the procedure.

Primary suture of septic lesions in the hand has been carried out with success by a number of clinics, and has a definite part to play in improving the results. Formal excision of the whole lesion has been advocated, but it is probable that curettage of the cavity, with occasional assistance from the excision of adherent slough, will give as good results.

The main difficulty lies in the fact that many clinics receive the majority of cases so late in the disease that skin necrosis is already established, primary healing is impossible, and eradication of infection leaves an ulcer which must heal by second intention—and which in a few cases even calls for skin grafting (Figs. 1, 2, and 3). Text books do not emphasise these cases, yet in certain areas they constitute a large proportion. Under present conditions, not more than 15 per cent. of the total are likely to resolve without suppuration. About 15 per cent. will have delayed healing because of ulceration. The remaining 70 per cent. may be expected to take seven or eight days. In most clinics 80 per cent. attend too late for any opportunity of resolution without tissue breakdown, even with the exhibition of antibiotics.

Adherence to the principles described above will nevertheless produce a steady improvement in the results. Such improvement is not merely due to the use of penicillin, for penicillin was in use for a number of years before the improvement occurred. It is due to an appreciation of when and how penicillin is combined with precise surgery, and due to modifications in surgical technique on the realisation that for a short time the patient's blood is highly lethal to the infecting organism.

If the average disability of all cases is estimated, the influence of these principles becomes apparent. A clinic which was in process of developing them over a period of four or five years gave figures which illustrate this.

The average disability for all cases of pulp space infection, in the years 1948 to 1952, was 28, 25, 16, 11½, and 10 days respectively. For subcutaneous abscesses of the web space, volar compartment of the finger, palmar, thenar, or hypothenar areas, during the same years, it was 19, 14, 14, 12, and 9 days respectively (see Appendix III).

These results, in a continuous series of four thousand septic hands, show that in five years the incapacity has been cut by half. It is not necessary for every clinic to go through this experimental era, and it should be possible for such improvements to be obtained elsewhere in a few months.

Subcuticular Infection.—Subcuticular infection exists in its own right as a septic blister. Removal of all the raised cuticle, and evacuation of all the pus are all that is required for cure. Particular attention to the edges, that they be clipped very close, is essential to prevent further spread.

Many subcutaneous lesions with soft tissue inflammation present with a subcuticular abscess on the surface (Fig. 25). When this is removed a sinus into the true abscess cavity or a slough of the true skin is revealed. Occasionally this sinus is minute. It may not be in the centre of the blister, and it may be unsuspected. The removal of cuticle and subcuticular pus should always be followed by gentle pressure round about, and if a subcutaneous abscess is demonstrated, it must be dealt with along the usual lines. When in doubt as to the existence of an underlying subcutaneous abscess, a subcuticular blister can be removed in the clinic, and if it is seen that further exploration is necessary, it is completed in the theatre under anaesthesia.

Some subcuticular lesions have a considerable amount of underlying inflammation, without any underlying abscess, and it is regrettable that anaesthetics are given to cases where snipping away dead skin—a painless process—is all that is required. If it is certain that the lesion is both subcutaneous and subcuticular, the whole procedure is, of course, left to the operation.

Some degree of subcuticular spread about an advanced abscess of the hand is quite common, and operative and post-operative toilet should include trimming it well back to avoid maceration and obstruction to discharges. Its removal also promotes collapse of abscess cavities for they are often held open by calloused cuticle, especially in manual workers.

In small children subcuticular spread, especially in the finger, may give rise to a progressive lesion which delays convalescence by considerable periods. It resembles impetigo in its insidious extension up the finger towards the hand, and requires daily toilet, removal of dead skin, and dressings. 5 per cent. chloramphenicol in propylene glycol has been found particularly effective as a local dressing, but gentian violet and other applications are equally popular. It is commonly believed to be due to streptococcal infections, but staphylococcus aureus is grown from it at least as frequently. The behaviour of an infection in this way is more likely to be due to the characteristics of the patient—a child or young person with loosely attached cuticle—than of the invading organism.

Simple subcuticular lesions, if adequately treated, may be expected to be dry and healed in two or three days. A protective dressing to avoid undue wear and tear may be required for one or two more.

Subcutaneous Infection.—For a number of years subcutaneous infections in the Sunderland Hand Clinic were analysed according to their situation, dividing them into such categories as volar compartment, web space infection, thenar eminence, superficial palmar abscesses, and so on. It became apparent that all these situations gave approximately equal results from treatment, and gave the same periods of incapacity, provided they were uncomplicated. Exceptions to this generalisation are the digital (terminal) pulp space infection, the deep (subaponeurotic) palmar abscess, and paronychia. These varieties are still assessed separately.

In all the others, the clinical features and the principles of treatment already enunciated are applicable without modification. 10 to 15 per cent. can be aborted by rest and penicillin, and about 15 per cent. attend for treatment so late that skin necrosis is established and healing is thereby inevitably prolonged. In the remainder, incision, toilet, and in some cases suture may be expected to obtain healing in seven or eight days. Primary suture is applicable to suitable cases of web space infection and the cavity can be obliterated by firm bandaging. Occasionally a volar compartment abscess or one on a thenar eminence can be treated similarly.

The abscess is incised in the obvious place—where it is closest to the surface—not by an approach through "classical" incisions. A web space infection, for instance, may often best be drained by a transverse incision at the base of the finger. When it is remembered that many of these arise by infection of a blister at the base of the finger, siting the incision there becomes the rational procedure; and if a commissural incision is made the skin at the base may subsequently give way anyway, and if so two lesions result. Exploration of the abscess cavity (the tourniquet ensuring a bloodless field) enables the surgeon to estimate with great accuracy spread of the infection and the viability of the surrounding fibro-fatty tissue. It also allows him to avoid damage to the digital neuro-vascular bundle, which may be considerably displaced by the abscess, and may in fact have been pushed into the direct path of a commissural incision. Others are more properly drained from the commissure. It is seldom necessary to make counter-incisions, even in doubled web space infections, if the whole cavity can be obliterated by toilet and subsequent firm bandaging. The incidence of recurrence of infection with this treatment should be less than 1 per cent.

Case History

A small boy attended with a septic hand, six days after onset. There was an obvious subcuticular collection at the base of the ring finger, and the subcutaneous tissue was swollen on the volar aspect, and on the dórsum between the ring and mid fingers (Fig. 25). Pre-operative high penicillin dosage was given, and a sphygmomanometer tourniquet was used. The cuticle was exactly excised and pus carefully mopped away. The skin had sloughed over an area about 4 x 3 mm. The slough was extracted and the cavity dried out. Pressure on the surrounding tissue showed extensions towards the midfinger, and towards the dorsum. These were also dried out. The whole cavity was gently curetted, and a dry dressing applied without packing. Firm bandaging in the clefts obliterated the cavity before the tourniquet was released. One post-operative injection of penicillin was given. The wound was redressed on the third and seventh days. It was healed on the ninth (Figs. 26 to 29)

Where skin sloughing has already occurred an incision is almost always superfluous. The sloughing skin, if still adherent, should be exactly excised and this will be adequate for the complete exploration of the underlying cavity. It is particularly unwise to add lateral incisions to an abscess in the volar compartment when a central skin slough is already imminent. It merely extends the slough. The blind lateral incision in volar compartment abscess is responsible for many cases of extension into the flexor sheath (p. 56). The intact sheath offers a robust resistance to infection from neighbouring tissue. Touching it with the tip of a scalpel destroys all its defences.

Subcutaneous infection at the volar creases over interphalangeal joints requires special mention. Here there is more fibrous than fatty tissue, and the sheath is very near. Particularly careful use of the scalpel is called for,



FIGS. 25, 26 27

infection with subcuticular pus. FIG. 26 (*right*)—It is
ıould be made, or whether an incision is necessary at
t is excised exactly, and pus is mopped away, but *not*
sinus is then revealed by pus and slough coming
through from the subcutaneous cavity.



FIG. 28

All pus is dried out, and ramifications detected by pressure from the periphery. The cavity is gently curetted No incision is necessary in this case.

FIG. 29

A dry dressing is applied without packing. The cavity in the cleft is obliterated by firm bandaging

and it is often better to allow these abscesses to approach the surface more nearly, which they do quickly—even at the risk of losing a little skin—than to cut around looking for pus which may not have formed. It may be assumed with reasonable certainty that if the hand is at rest and penicillin is controlling the surrounding cellulitis these abscesses will come to the surface before they spread to the sheath. (This does not, of course, apply to penetrating wounds which have reached the sheath in the first instance.) This situation for subcutaneous infection is not usually described as such, and some authorities imply that pointing here is always indicative of a volar compartment infection. Abscesses primarily arising in the volar crease are not uncommon, however, and they require a most cautious approach (p. 59).

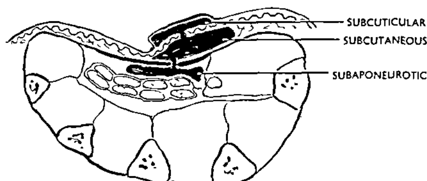


FIG. 30
Deep palmar (subaponeurotic) abscess has its deepest loculus between the palmar aponeurosis and the tendon sheaths The mid-palmar space lies between the tendon sheaths and the muscles. It is *very seldom* infected. Subaponeurotic abscesses should be approached directly, through the palmar fascia.

Another impression sometimes erroneously acquired is that one *never* incises on the dorsum of the hand, because the pus is *always* nearer to the volar surface. Dorsal cellulitis progressing to a subcutaneous abscess, is, nevertheless, occasionally met. There are, of course, no tendon sheaths on the dorsum of the distal half of the hand, but pus can occasionally be traced below and about the extensor tendons, with a tendency to follow their course. Dorsal infections of this type are usually from penetrating wounds, or are a complication of hair follicle infections. A boil on the hand, or the dorsum of a finger, occasionally fails to localise before more extensive subcutaneous suppuration supervenes. In these cases the general policy to avoid operating on hair follicle infections must be abandoned, as it is the complication of subcutaneous extension which determines treatment (p. 13).

The *deep palmar abscess* is naturally to be suspected from the presence of excessive dorsal and palmar swelling. It localises on the volar surface, and presents as a subcutaneous abscess, sometimes with a subcuticular extension. It may, in fact, be a "collar-stud" abscess with an extra bulge (Fig. 30). Removal of cuticle reveals a sinus. Incision to investigate this should be made

in a direction parallel with the nearest palmar crease (it is usually the curved crease at the base of the thumb). Exploration of the subcutaneous abscess (always under the tourniquet) further reveals a deeper sinus coming between the fibres of the palmar aponeurosis. The fascia is incised in the direction of its fibres, and the edges retracted. Pus must be dried out from amongst the flexor tendons and the neuro-vascular bundles. One does not curette or abrade down there, but the deep ramifications must be fully explored. The palmar fascia is excised in those parts which are necrotic, leaving a small channel to the surface for any further exudation. Occasionally it may be possible to suture the incision without tension but in most cases there is at least a little skin necrosis, and the skin of the palm is most unyielding. These facts combine to prevent suture. Deep palmar abscess is rare, and its incidence in all cases of hand infections seldom exceeds 0·2 per cent. This means, in most clinics, less than two a year.

It is often erroneously diagnosed as a *middle palmar space* abscess. The mid-palmar space lies deep to this situation, between the tendon sheath and the plane occupied by metacarpals and interossei. Mid-palmar space abscess is *extremely* rare. In the series examined it never occurred at all. If it occurs, it is usually secondary to long-neglected tendon sheath abscesses of the middle or ring finger which rupture at their proximal end. Such a complication should never arise in a civilised community with modern facilities.

Other cases misdiagnosed as mid-palmar space infection are web space abscesses extending across the base of a finger into the adjacent web space, and distally along the sides of the finger towards the collateral aspects of the proximal inter-phalangeal joint. This extension is suspected of being "along the lumbrical canal", and tempts the surgeon to make blind thrusts proximally into a very complex and important part of the hand.

Precise exploration under the tourniquet, following the course of the pus itself, drying it away before the next advance is made, and identifying each ramification as it is revealed, will lead to complete evacuation and rapid recovery with good function. It will also avoid the invasion of uninfected regions with contaminated instruments, and damage to nerves and vessels which may often be observed threading their way unconcernedly across the abscess cavity.

Thenar space infection is equally rare Exploration of cases suspected of it, after localisation is established, nearly always reveals that the pus lies entirely between the skin and the fascia overlying the thenar eminence (p. 96). It may spread most extensively in this area, but it is invariably profitable to explore it thoroughly before assuming that the intermuscular planes are involved. Blind incision, because the base of the thumb is "ballooned", through the first web or to the radial side of the second metacarpal has little merit. "Antibiotic decompression" will show, in a day or two, where the infection truly lies. Thenar space infection, also, used to occur by rupture

of untreated tendon sheath abscesses (in this case, the tendon of flexor pollicis longus). The primary condition is now cured before such a disaster.

Subcutaneous infections which, after apparently adequate treatment, develop a persistent sinus, or recur, should be suspected of a retained foreign body, especially a wooden splinter, before a rare, chronic, or antibiotic resistant infection need be considered. Patients seem to acquire these without noticing, or forget that they have done so. Histories of penetrating foreign bodies are extremely unreliable. The possibility should never be forgotten, whether the history suggests it or not. The opposite mistake is also often made, for a patient will report that he " must have got something in " with no more to justify it than the fact that he has developed a septic lesion. Such a history is occasionally prompted by considerations of compensation payments as against sick benefit (p. 212), and lead the surgeon to unprofitable searches in the subcutaneous tissue or unnecessary X-rays.

Pulp Space Infection[1].—Results of treating infections in the pulp space offer the most striking vindication for the conservative trend. Cases seen before pus has formed, if treated by rest and penicillin, will entirely resolve in about 50 per cent. Most of the rest will localise to a small abscess which can be drained by an incision directly over the point of maximum tenderness. Debridement of the cavity and a dry dressing kept dry, allow obliteration without any indication for suture, and healing may be expected in a few days.

This has virtually abolished the " hockey stick " incision as the routine treatment of early cases. Complete immobilisation of the hand, and adequate penicillin injections, are almost invariably followed by subjective improvement, so that localisation can be awaited without fear of allowing complications to supervene. Within one or two days, therefore, an incision can be made which is suited to the individual case. Frequently the situation of the abscess is betrayed by a small subcuticular collection, and exploration of this reveals a sinus into the cavity (Fig. 51).

There are a few cases, however, in which conservative treatment does not result in relief, and does not result in localisation to any precise spot. Any patient, therefore, who reports a sleepless night from the painful digit after twenty-four hours' treatment with splintage, elevation, and penicillin, and shows no sign of localisation to a site suitable for incision, should have a single incision in the classical situation. These cases usually produce a little deeply situated pus, surrounded by pulp tissue of almost uniform thickness, and it is often under considerable tension. The incidence of such cases does not exceed 1 per cent. of the total number of pulp space infections.

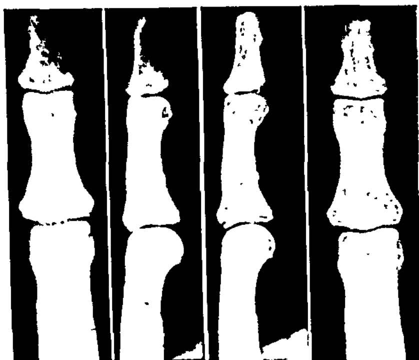
As with subcutaneous infection elsewhere, the great majority of cases attend so late that suppuration is well advanced. In these there is a history of a number of sleepless nights, with increasing pain. The infection is often dammed back by a tough, adherent area of sloughing skin, and there is a

[1]The term " pulp space " is sometimes erroneously applied to the volar compartments It should be confined to the distal segment of the finger or thumb.

considerable amount of soft tissue and skin loss when the case is first seen. This results, at the least, in delay in healing, and is not infrequently associated with bone, joint, or tendon infection. If, in addition to this damage, a lateral incision is made " to reduce the tension," further sloughing may be provoked, and, as will be described, the very complications which are threatened may be precipitated.

In the early case, therefore, the " hockey stick " incision is almost always unnecessary. In a case where tissue loss has already occurred it may be definitely harmful. The " hockey stick " incision, in short, has almost gone.

The " alligator " incision is mentioned but to be condemned.



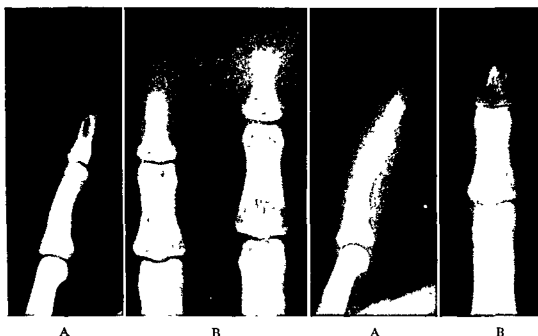
FIGS. 31 and 32

FIG. 31. X-ray of distal phalanx seven days after the onset of a pulp space infection Decalcification of the volar part may be misinterpreted as serious bony disease FIG. 32. Same case as Figure 31. Within three weeks the bone has been recalcified and has returned to normal.

Controversy still wages over the mechanism by which spread to the phalanx occurs, but, whatever conception of pathology one favours, the incontrovertible fact is that a central abscess of the pulp destroys the normal mechanism of blood supply to the distal two-thirds of the phalanx, and the bone is in jeopardy.

X-ray pictures of the phalanx taken during the progress of a pulp space infection are frequently used as evidence of bony destruction, but their interpretation in this condition offers certain pitfalls. Inflammation of bone can be compared with inflammation of soft tissue. It can sustain an increased

blood supply and suffer an inflammatory process without any destruction of its living cells, in the same way as soft tissue can become inflamed without necessarily forming pus. The increased blood supply causes decalcification, and rarefaction of the normal X-ray opacity, even to the disappearance of *all* bony shadow from the volar part, without any permanent damage to the matrix. The hyperaemia common to all living tissue surrounding an abscess affects the phalanx in this manner and the fact that X-ray rarefaction is demonstrable does not, of itself, indicate that permanent bony damage is established.



A B A B
FIG. 33 FIG. 34

FIG 33 X-ray of distal phalanx seven days after the onset of a pulp space infection. Although at a similar stage to the case in Figure 31, no bony change is apparent
FIG 34 Same case as Figure 33 ten days later. The distal two-thirds have sequestrated
Figures 31 and 32 show that early X-ray signs do not indicate permanent bony destruction Figures 33 and 34 show that the absence of early signs is no indication that bony survival is secure.

Fig. 31 shows an X-ray picture of this condition The causative pulp space infection was overcome by the usual methods, and the bone became recalcified, restoring the original picture within three weeks (Fig. 32). If rarefaction of this nature is taken to indicate osteitis, the incidence in any series will depend to a large extent on one's enthusiasm for taking X-rays.

Just as this stage may, in soft tissues, proceed to molecular disintegration of the living cells and the formation of pus, so in bone may the hyperaemia proceed to the destruction of the matrix, and produce a destructive osteitis which gives rise to a permanent deformity of the phalanx. This condition, in which the structure of the living bone is destroyed, produces in its early stages an X-ray picture which is not necessarily as striking as the one described

above. In fact, decalcification (and therefore rarefaction on an X-ray plate) is less likely to occur if bone destruction is sudden. Fig. 33 was taken from a case of pulp space infection of approximately the same duration as Fig. 31. Fig. 34 was taken from the same case as Fig. 33, ten days later, and a sequestrum was ultimately discharged leaving a permanently deformed finger-end.

Thus the early stages of bone necrosis cannot be diagnosed from X-ray, and this fact has given rise to a fallacy which is widespread. Because the early stages cannot be detected, it is often assumed that, where sequestration takes place, the irreversible osteitis is always already established by the time that the case reports to the clinic. Thus all cases of sequestration and prolonged incapacity from bone infection have been attributed to delay in the institution of proper treatment.

Many of them, of course, undoubtedly are, and the incidence of bone destruction rises steeply with the length of time between onset of pain and the operation. In over one thousand pulp space infections with at least one hundred cases of osteitis, it occurred in no more than five cases attending within three days of onset, and only two went on to sequestration.

Nevertheless, delay is not the only factor, and probably not even the main one. The principle cause of sequestration of the distal phalanx is the "hockey stick" incision, made upon *late cases*, where extensive soft tissue disintegration has taken place.

The nutrient artery is described as an end artery, and in injection experiments upon the normal finger this is probably correct. But soft tissue which remains attached to bone is capable of increasing the periosteal supply under emergency conditions, and the distal phalanx very frequently survives the loss of its main vessels by deriving sources from the columns of soft tissue attached to the sides. If this were not so, *every* case of central abscess would proceed to sequestration. If the normal vessels are destroyed by disease, and the emergency supply is cut off by "hockey stick" incisions, the phalanx lies in double jeopardy, and has lost its reserve chance of survival (Fig. 35).

The highest incidence of sequestration in the series of a thousand cases already referred to was in the year (1948) the "hockey stick" was most extensively used. In 1947, 1948, and 1949, 438 cases of pulp space infection were treated, almost always by "hockey stick" incisions. Thirty-two sequestrated. The average incapacity of all these cases was 25 days. In 1950, 1951, and 1952, 628 cases were treated by conservative measures with local incisions, or with excision of existing slough. (Three early cases were treated with "hockey stick" incisions for the reason already given above.) Only 5 produced sequestra. The incapacity of all cases averaged 12 days.

The association of paronychia with pulp space infection is more often suspected than found. Many pulp abscesses produce redness and swelling of the nail fold. Even fluctuation may be suggested, and yet no pus is found under the nail or nail fold itself. It is not uncommon to see removal of part

or all of the nail at operation for pulp space abscesses, without it serving any useful purpose.

Use of the tourniquet at operation with careful exploration of the abscess cavity as the first part of the procedure, will show that at least three distinguishable conditions occur.

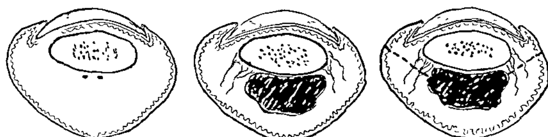


FIG. 35

i The arteries of supply to the distal two-thirds of the phalanx run close to the volar surface of the periosteum *ii Destruction of these arteries by a central pulp abscess is compensated by the dilatation of other vessels from the soft tissue to the periosteum* iii "Hockey stick" incisions to drain the abscess cut these compensatory vessels and increase the danger of bone necrosis

1. A pulp abscess may occasionally point into the nail sulcus. In most such cases pus has also approached the volar surface or raised the cuticle elsewhere and the exploration will have been made through some part of the pulp. It can be traced in the bloodless field from there to the nail area, and any nail raised by the infection can be removed. Drainage will therefore be, in most cases, through the volar approach, and the sinus into the nail bed heals soon after operation. (Fig. 36).

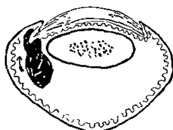


FIG. 36

An abscess in the lateral part of the pulp space may point in the nail sulcus and raise some of the nail before it points elsewhere.

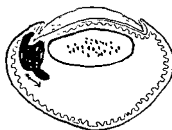


FIG. 37

An abscess in the nail fold (subcutaneous paronychia) may extend into the lateral part of the pulp space before it ruptures into the nail sulcus.

2. A paronychia may on rare occasions track forwards into the pulp space, and produce a situation very similar to the first. Here operation is more likely to have been initiated in the nail fold or nail sulcus. This will be referred to again later (p. 49) with other forms of paronychia (Fig. 37).

3. This type is unfortunately commoner than either of the others. It concerns the late, neglected cases in which the finger end has become replaced

by a "bag of pus." In the later stages of these abscesses pus points near the tip in the midline, and at the same time tracks round the sides of the phalanx, raising *nail and nail bed together*, so that an associated paronychia is quite closely simulated (Fig. 38). Evacuation of the pus through the central sinus should be carried out, and there is so much soft tissue destruction that approach to the area between phalanx and nail bed is easy, without making any counter-incisions. Avulsion of the nail or cutting flaps in the nail fold is mischievous, and greatly increases the patient's discomfort to no good purpose. Furthermore, it prolongs the disability because the raw nail bed may become infected by discharges and then takes a long time to heal.

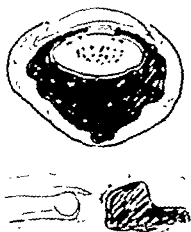


FIG. 38

The usual course for a neglected pulp space abscess is round the phalanx, on one or both sides, between the nail bed and the bone. Nail and nail bed are raised together. It points in the midline at the tip

CASE HISTORIES

CASE 1 A girl of eighteen reported to her family doctor with spontaneous pain in the thumb pulp space of twenty-four hours' duration. He advised poultices. After five days treatment she was referred to hospital. She had had no penicillin, nor had she been advised to immobilise the hand. A pulp abscess was evident, with pus under the cuticle over an area ¾" x ½". Pre-operative penicillin routine was given and operation carried out with a sphygmomanometer tourniquet round the upper arm. The cuticle was removed, and a slough of almost the whole of the centre of the pulp space was extracted. The volar surface of the phalanx was exposed. A dry dressing was applied. The whole hand was immobilised for twenty-four hours, and penicillin given on the first post-operative day. On the third day a dry crust was over the lesion, but more pus was evacuated from alongside this. On the seventh day the cavity was closing in, with a small central granulation. On the eleventh day the lesion was dry and scabbed over. She was discharged with instructions to avoid getting the dressing wet for the next few days.

CASE 2. Letter from family doctor:—

"This girl has a pulp space infection. It started two days ago. She saw me yesterday. I gave her 500,000 U. aqueous penicillin and immobilised the hand. I gave her the same again today but she reports a sleepless night and is showing no improvement."

She had a localising superficial (but very painful) infection. A small incision in the midline halfway between the interphalangeal crease and the tip (this was the most tender spot) evacuated an abscess cavity the size of a split pea. Three days later the wound was dry and she was dismissed in five days.

CASE 3. Letter from family doctor:—

"This little boy saw me today for the first time. He has an infected finger which started a week ago. He has treated it at home with sugar and water. As you see, infection is extensive and I think the bone is necrosed."

At operation, the whole of the soft tissue of the pulp was destroyed, except for a narrow column still attached to the lateral side, and along about half of the nail bed. The finger end was distended with pus, not discharging, but pointing

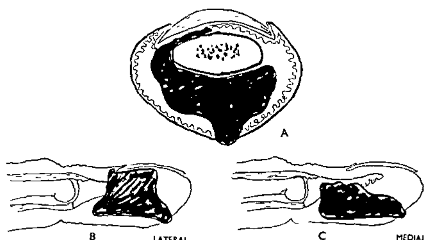


FIG. 39

Case 3 in the text [illegible]
infection The colu[illegible]
side was carefully [illegible]
maintain nutrition [illegible]
lateral side of the tip.

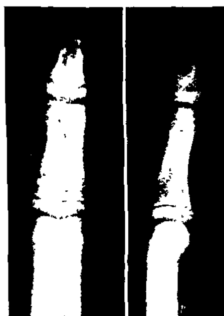


FIG. 40

Same case as Figure 39. X-ray appearance three weeks after treatment

under the cuticle in the midline at the tip. The distal two-thirds of the phalanx were separated from all soft tissue, except for the column already described (Fig. 39). Using the penicillin operative routine, the abscess was drained through

the pointing area, and all pus was dried out No incisions were made. The nail was not removed. A swab taken at operation grew penicillin sensitive staphylococcus aureus.

The attached soft tissue, which was carefully preserved at operation, sufficed to maintain nutrition of the whole of the bone, except for a very small part of the tip (Fig. 40). The length of treatment was twenty-one days. He made seven attendances.



FIG. 41
Deep infection of the pulp space pointing under calloused skin at the finger tip.

CASE 4. Letter from family doctor:—

"Will you kindly take over treatment of this man? A week ago he pricked his finger. Three days ago he reported pain and swelling, and since then he has had a daily injection of 300,000 U. penicillin suspension, with immobilisation in a sling. Pain has been relieved and he has improved, but there is pus near the surface this morning."

The usual penicillin injections were given. Operation showed a lateral pulp space cavity with a small slough of the overlying skin. The slough was excised and the cavity cleaned out. A firm dry dressing was applied. The wound was redressed on the fourth day.

Letter to family doctor:—

"Your patient had a pulp space infection requiring excision of slough and evacuation of an abscess. The lesion should be healed in two or three days from now. I am returning him to you for dry dressings because he lives at H—— and finds the journey expensive."

CASE 5. A man reported persistent pain in the pulp space following a slight crush a fortnight previously. The tip was covered with calloused skin and maximum tenderness lay under this area (Fig. 41). Conservative treatment for twenty-four hours failed to give relief and operation was carried out with the usual

routine. The calloused skin was removed, together with a fragment of the end of the nail which overhung it. A small slough of skin was excised and the underlying sinus explored It led into the centre of the pulp space. Pus was evacuated and the cavity gently curetted (Fig. 42). A dry dressing was applied without packing.



FIG 42
The calloused skin has been excised, and overlying nail removed The sinus and abscess cavity have been curetted A dry dressing is applied without packing



FIG. 43
Five days later the lesion is dry and scabbed over It was quite painless within three hours of the operation, and remained so

Within three hours the finger was free of pain, and remained so. The lesion was dry in five days, and required no further treatment (Fig. 43).

CASE 6. A woman reported an infection of the finger which had been treated at home for eight days. On attendance the distal segment was uniformly swollen and painful. The proximal part of the pulp showed an area of subcuticular

pus, but the finger was not discharging (Fig. 44). Under penicillin routine, and using the sphygmomanometer tourniquet, the cuticle was exactly excised, revealing an area of sloughing skin (Fig. 45). This also was excised, pus from the underlying space was mopped out and further subcutaneous slough excised. The volar surface of the phalanx was exposed in the base of the cavity, but there were lateral and distal soft tissue attachments which were carefully preserved (Fig. 46). The cavity was gently curetted.

A dry dressing was applied without packing. The finger was redressed twice weekly, and continued to discharge a little pus for nine days. After this healing was rapid and was complete in sixteen days. There was no further sloughing, and no destruction of the phalanx.

Infection of the fibro-fatty tissue at the tip of the finger produces a local abscess or slough, involving the tip of the nail bed. Its roof consists partly of nail, and partly of cuticle. A wedge-shaped fragment of nail, rather larger than the area of the abscess under it, should be removed, and the cuticle over the pulp half of the abscess removed with it (Figs. 47 and 48). It is very rare for the subungual infection to spread far, and routine removal of the whole nail is quite unnecessary. X-ray examination very frequently shows a localised loss of bone shadow at the tip of the phalanx. It is of little permanent significance. Over two hundred cases have been healed after this treatment and there has been no sequestration. It is very rare indeed for this type of infection to spread extensively in the pulp space, and drainage of the rest of the space is not called for. It must be distinguished from pulp space infections pointing in the midline close to the tip (p. 41), but such distinction provides little difficulty on sight in all but a very few cases, and none at all at operation.

No septic condition of the hand gives better returns from careful and intelligent surgery than the pulp space infection. It is the commonest septic hand condition giving rise to prolonged incapacity and permanent deformity. Its incidence in this country each year probably exceeds 50,000 cases. If the sequestration rate can be reduced from 10 per cent. to 1 per cent., as in the figures quoted, and if the period of disability can be reduced by one-half, precise treatment of this condition alone will avoid much minor disability in the community. Iselin in 1941 estimated the sequestrum rate as over 20 per cent.

Paronychia.—Paronychia is an individualistic condition. Whereas septic hand conditions as a whole are much commoner amongst the "working classes" paronychia is no respecter of persons. The length of history gives no indication of the stage of the disease—one case may progress as far in twenty-four hours as another in four or five days. A discharging lesion may be early or late. A paronychia which has been well established for three months may be cleared up with treatment in a week. Another, with two days' history, may take a month to heal. It has been treated in the first week of life, and in the very old. It is, in fact, not uncommon in infants, and trauma

routine. The calloused skin was removed, together with a fragment of the end of the nail which overhung it. A small slough of skin was excised and the underlying sinus explored. It led into the centre of the pulp space. Pus was evacuated and the cavity gently curetted (Fig 42). A dry dressing was applied without packing.



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CASE 6. A woman reported an infection of the finger which had been treated at home for eight days On attendance the distal segment was uniformly swollen and painful. The proximal part of the pulp showed an area of subcuticular

to the tender finger nails, by catching them in knitted shawls with holes in, is one of the causes. Its response to penicillin in the usual doses is uncertain, and its bacteriology is atypical.

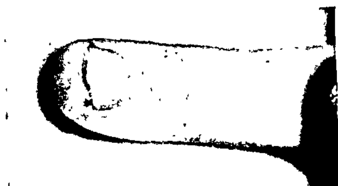


FIG. 47
This type of case must be distinguished from that illustrated in Figure 41. This is a small slough of the terminal part of the nail bed, with little tendency to spread.



FIG. 48
A little of the distal portion of nail is removed, and the cavity is eradicated by a small curette or dry gauze

The surgeon's approach to the treatment of paronychia may be simplified if it is appreciated that two distinct processes have to be considered in an infection around the nail bed. The earliest stage in the development of either is a subcuticular infection of the nail fold, and if this is drained and sterilised before it spreads to the subcuticular tissue under the nail, resolution takes place (Fig. 49). If it " turns the corner " spread about the base and sides of the nail may be rapid, especially if it *remains* a subcuticular infection. This type is clearly described in Pilcher's article and the recommended treatment is removal of that part of the nail which has been detached by the infection. In this type there is no indication for incision into the nail fold, though occasionally it may be advisable to hold the fold open with a light gauze drain for twenty-four hours if it threatens to attach itself prematurely. In



FIG. 44
An advanced abscess of the pulp space with subcuticular pus, sloughing of the skin, and sloughing of the fibro-fatty tissue between the skin and the phalanx.

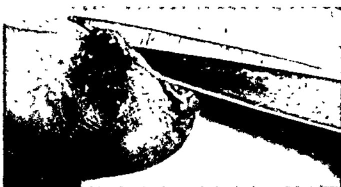


FIG. 45
Exact excision of the raised cuticle evacuates pus and reveals the extent of the lesion



FIG. 46
Careful toilet of the cavity and removal of slough can be performed adequately through the area of skin loss. There is no indication for any incision.

to the tender finger nails, by catching them in knitted shawls with holes in, is one of the causes. Its response to penicillin in the usual doses is uncertain, and its bacteriology is atypical.



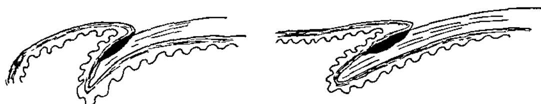
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the majority of cases, when combined with antibiotic therapy, the lesion is dry in five or six days and the patient can be dismissed with instructions to weär a protective dressing until the new nail thrusts away the attached and remaining fragment.



A FIG. 49 B

A subcuticular infection either (A) of the nail sulcus, or (B) of the nail fold tends to spread in both directions If it "turns the corner" and involves the cuticular layers of the nail bed, conservative measures are unlikely to succeed.

There is never any indication in the treatment of paronychia to remove any *distal* part which has remained attached to the nail bed, for these parts are very liable to develop granulating ulcers which seriously delay recovery. On the other hand, experience has shown that if any part of the *base* is to be removed, all that nail which is covered by the nail fold must be removed also, whether it has been detached by the infection or not. If a cut edge of nail is overlapped by nail fold, infection tends to persist at that edge and a small granulation develops.

The original subcuticular infection of the sulcus may, however, pursue a different course, and, at an early stage, invade the subcutaneous tissue at one corner of the nail base. This type is not uncommon (Fig. 52). It shows more surrounding inflammation and swelling, usually causes more pain, and presents as a small abscess, with little or no nail detachment, at one angle of the nail fold. If there is delay in attendance, it may have spread rather slowly across the nail base towards the other side. It may, in addition, have formed a sinus to the surface and show a subcuticular collection *secundum artem* (Fig. 50). Most of these cases, however, report early, before the onset of such complications, because of the pain. An incision alongside the nail fold and debridement of the small cavity, expression of any pus under the nail which may be detected, and a firm bandage, using the high pre-operative dosage of penicillin already recommended, produces healing in a few days. In the majority of these there is no indication for the removal of any nail whatever.

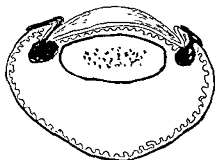


FIG. 50

Subcutaneous paronychia may point at the nail sulcus, or penetrate it, and raise the cuticle over a considerable area before it ruptures It then bears a superficial resemblance to subcuticular paronychia.

Paronychial infection in the subcutaneous tissue may spread forwards to the pulp space instead of towards the surface at the edge of the nail, as has

been mentioned already (p. 40). An incision down to the abscess, if followed by careful exploration of its extensions, will reveal this complication and if it is evacuated and its lining eradicated no serious prolongation of disability need be expected.

It may not always be possible to distinguish the subcuticular from the subcutaneous type when examining the case, but it is possible and profitable to do so at operation. Here again, a precise assessment of the nature of the lesion, by exploring it in the bloodless field, avoids unnecessary avulsions and the consequent development of infected granulations in the nail bed (Fig. 51).



FIG. 51

This resembles a paronychia superficially, but is actually a small pointing abscess in the lateral pulp space. It requires *neither* nail removal *nor* incision. It is drained by removing the cuticle. The pus is carefully cleaned out from the underlying cavity in the subcutaneous tissue, and the lining is abraded by dry gauze. Firm bandaging will obliterate the cavity and healing takes place in four or five days.

Although no definite rules can be laid down, the purely subcuticular paronychia, producing a considerable collection of pus under the nail, tends to affect children and young people. It tends also to rupture easily and discharge on the surface. If this occurs, prolonged opportunity to acquire secondary infection has been given. One may consequently make the generalisation that those lesions which have not discharged (and which include most of the subcutaneous type) are almost always infected by penicillin sensitive organisms (staphylococc [illegible] with haemolytic streptococci). Those which [illegible] redominantly infected by the same organisms [illegible] idence of the other types—*B. coli, B. proteus,* [illegible] (if treatment in hospital is prolonged) penicillin resistant staphylococcus.

All these organisms remain sensitive to chloramphenicol[2]. As, in addition, the lesion is usually subcuticular, and as it has been rendered entirely

[2] Many hundreds of organisms from the department have been cultured during the last seven years. There is only *one* record of a staphylococcus aureus which was resistant to chloramphenicol.

accessible by surgery, the topical use of this antibiotic is very valuable. Its application to this type of paronychia as a post-operative dressing has reduced the average disability by significant amounts. The operative routine is carried out using penicillin cover (the chances of its being effective remain greater than four to one) but any persistance of discharge on post-operative dressings indicates the use of the second antibiotic. It is applied as a 5 per cent. solution in propylene glycol. There have been no sensitisation reactions so far.

A series of bacteriological examinations on consecutive cases of paronychia gave:—

Unruptured lesions	Penicillin sensitive staph	26
	Penicillin sensitive staph. and haemolytic streptococcus	4
	Penicillin sensitive staph and *B. Coli*	1
	B. proteus	1
Ruptured lesions	Penicillin sensitive staph.	19
	Penicillin sensitive staph. and haemolytic streptococcus	6
	B. coli	3
	B. proteus	1
	Penicillin insensitive staph.	4

This series of sixty-five swabs shows only two exceptions to the generalisation that unruptured lesions are sensitive to penicillin. The insensitive organisms occur in ruptured (and usually entirely subcuticular) lesions. Even in these their occurrence is rare enough for the use of penicillin to remain an effective routine. In those which fail to respond promptly, careful toilet with local application of chloramphenicol will subdue the residual infection.

Case Histories

Case 1. A young woman reported infection of the nail sulcus of four days' duration. The whole nail fold, and the lateral sulcus were red, swollen and inflamed Tenderness and swelling were maximal at the angle between fold and sulcus. She was given the usual penicillin routine. In a bloodless field an incision was made into the nail fold in line with the sulcus, and pus evacuated (Fig. 52) The cavity lay partly under the nail, but nail detachment did not extend for more than 2 mm The cavity was rubbed with dry gauze and the nail firmly compressed to evacuate what little pus lay under it A firm dry dressing was applied without packing and the tourniquet released.

On the third post-operative day the dressing was removed revealing a dry lesion with a linear crust of dried blood Pressure was painless and failed to produce any discharge. The wound was redressed with a little dry gauze and bandage. The patient was dismissed with instructions to keep the whole bandage dry for two more days The operation swab grew penicillin sensitive staphylococci

CASE 2. A patient of nineteen reported a five days' history of nail infection. The nail was almost entirely raised from its bed by thin pus, which had spread also under the cuticle of the nail fold and on to the dorsum of the finger almost as far as the distal interphalangeal joint (Fig. 53). The same penicillin routine for

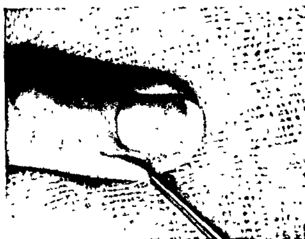


FIG. 52
This paronychia is a subcutaneous abscess at the proximal end of the nail sulcus. There is little or no extension of pus between nail and nail bed. Therefore there is no need to remove any nail It requires an incision into the nail fold in line with the sulcus, and careful eradication of the lining of the abscess cavity

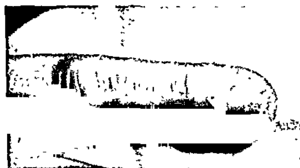


FIG. 53
Infection in this paronychia lies entirely between cuticle and dermis, under the lateral part of the nail and extending on to the adjacent part of the finger. Removal of cuticle and that part of the nail raised by pus is indicated There is no need of an incision into the subcutaneous tissue

the operative and first post-operative days was given. Under a tourniquet the raised cuticle was excised at the extreme limits of the blister, and the lateral parts of the incisions lifted the nail from its bed except for a small area still firmly attached to the distal end. This area was carefully retained, and the rest of the nail

removed. The pus was thoroughly cleaned away from the nail fold. There was no subcutaneous extension. A dry dressing was applied without packing. On the third post-operative day the dressing was removed to reveal some purulent discharge from the nail fold. This was cleaned away with dry gauze and a drop of 5 per cent chloramphenicol in propylene glycol instilled into it. A dry dressing was again put over the lesion without packing. On the sixth post-operative day it was healed. He was dismissed with instructions to return to work with a dry dressing over the finger until the nail grew again. The operation swab grew penicillin sensitive staphylococcus aureus and haemolytic streptococci.



FIG. 54
A paronychia with subcuticular pus

CASE 3. A girl of twenty reported with a fortnight's history of slowly developing paronychia. There was a moderate amount of swelling of the nail fold, and its edge was raised by a subcuticular collection of pus (Fig. 54). There had been no discharge from it. With high pre-operative penicillin dosage the lesion was explored in the bloodless field. The cuticle was excised, and much pus under the nail fold dried away. About two-thirds of the base of the nail were raised by pus tracking under it The whole of the nail base was removed, and the nail fold dried out with gauze. A dry dressing was applied without packing (Figs. 55 to 57). One post-operative injection of penicillin was given. The wound was redressed on the third post-operative day. It was healed and dry on the fifth (Fig. 58).

When operating on cases requiring removal of the base of the nail a deliberate inspection of the nail fold is essential. Small pieces of nail inadvertently left there provoke persistent discharge and the development of resistant infections. A film of partly detached, macerated cuticle, lying on the under surface of the fold, will create the same complication. All debris must be picked out with forceps at the time of the operation, and it may be necessary at the subsequent dressing to remove similar tags which have developed or been missed. The patient will prefer these to have been dealt with under anaesthesia.

In cases where an incision is indicated precise siting will bring its own rewards. Nails vary in their appearance, from the "transverse" type to the "longitudinal." In the transverse type the proximal part of the sulcus tends to be overlapped by the fold, to an increasing extent as the base is approached (Fig. 59). An incision to drain this fold may have to begin almost at the

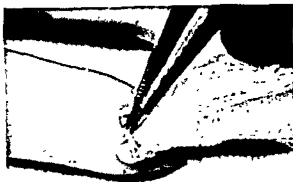




FIG. 55 FIG. 56

FIG. 55. The cuticle is excised, and pus cleaned away with dry gauze. FIG. 56 Raising the base of the nail shows that much of it is separated from the nail bed by pus extending under it.





FIG. 57 FIG. 58

FIG. 57. The *whole* of the base of the nail (that part which is normally covered by nail fold) is excised. A dry dressing is applied without packing The nail fold is carefully dried out on the third day FIG. 58. On the fifth day the nail fold is dry and scabbed over

distal end of the nail (Fig. 52). In the long, narrow type the incision is short, and begins at the base itself. All variations between these extremes may be met, and different varieties may be found on the same hand. If the incision is sited too near the midline, the infected sulcus may drain inadequately and lead to persistence of infection. An incision should never be extended further than the proximal limit of the nail fold. On the rare occasions when a subcutaneous cavity has extended more proximally, it can be explored from its distal end with a little gauze held in forceps. The dorsal aspect of the joint cavity approaches the proximal end of the nail very closely in some fingers, and

over-enthusiastic flap reflection may produce suppurative arthritis. The only cases of suppurative arthritis occurring as a complication of paronychia, in this series, were in the days when full reflection of the nail fold was carried out as a routine (Appendix III).

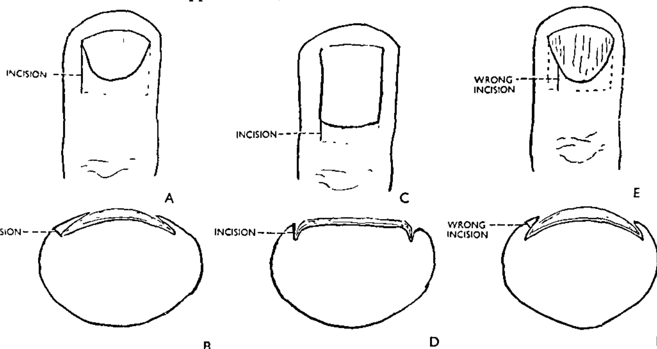


FIG. 59

Variation in shape of the nail A and B—Broad with a deeply curved edge to the nail fold The majority of the nail sulcus is hidden. C and D—Long and narrow with a straight nail fold. The nail sulcus is exposed for most of its length. In type A the incision to expose the outer limit of the nail is carried almost to the end. In type C the incision is short. Incisions which are made medial to the lateral border of the nail bed fail to drain the sulcus properly (E and F).

Tendon Sheath Infection.—Two entirely different conditions result from infection of the tendon sheaths, and they may be related to the nature of the infecting organism.

1. The *fulminating, rapidly spreading* infection affecting the whole length of the sheath is the one classically described. This gives rise to the tense, flexed, swollen finger whose active movement is impossible, and whose passive movement is exquisitely painful and deeply resented. Maximal tenderness is over the proximal end of the sheath, or, in the fifth finger, over Kanavel's point—the midpoint of the fifth metacarpal.

Nowadays constitutional disturbance is less often noted, because of early antibiotic control. The incidence itself would now appear to be under 0.5 per cent. of all septic hands coming to hospital, because many cases are cured in their early stages by prophylactic injections of penicillin given by the general practitioner.

The usual cause of this condition is a penetrating wound by a needle or other sharp instrument, or, not uncommonly, a bite from a kitten.

From the time when it was recommended that the infected flexor sheath should be incised in its whole length, to the present day when surgical drainage of any type is very seldom used, spans only a few years—yet it covers as revolutionary a change as can be noted in surgical history. However carefully the incisions were made, and however carefully the fibrous pulleys were preserved, the old radical measures were expected to leave a stiff finger, often with no range of movement at all; and the number coming ultimately to amputation was formidable.

Progress towards absolute conservatism has been cautious; through a phase in which the tendon sheath was exposed, drained by a ureteric catheter, and irrigated with aqueous penicillin; through a phase when the sheath was opened, drained, irrigated, and the wound entirely closed, to one where it was irrigated through hypodermic needles without an open operation—and to the present time when by far the majority may be expected to resolve with no more than intensive antibiotic therapy, and rest to the whole hand by complete splintage. It is now unusual for In-Patient treatment of these cases to be required, and more unusual still for any surgical drainage. Where surgical drainage does prove to be necessary, exposure of the sheath at each extremity, irrigation through minimal incisions, and primary closure is probably the best method.

These cases, in which the limits of the infection depend on the anatomical limits of the sheath, show all the features of a streptococcal invasion, and, as may be expected, provided they are treated early they respond to penicillin. The routine for the conservative treatment of acute septic conditions (p. 4) is adopted, and the majority abate satisfactorily. Aspiration of the sheath, in addition to these measures, has been necessary in one case only in the last three years, and was carried out on the third day of penicillin therapy. The fluid was sterile.

2. *Local infections* of a segment of the sheath are more common. Adhesions at the extremes of the infected area are often firm, and effectively prevent spread to other parts. Consequently the classical signs of a sheath infection do not appear. Limitation of passive movement is not absolute, and a considerable range of painless movement at the unaffected joints may be possible. The metacarpo-phalangeal joint, for instance, may be quite unaffected by an infection in the middle segment, although the more distal part of the tendon may be actually sloughing. Occasionally a sympathetic effusion into the rest of the sheath may produce tenderness at the proximal limit, but this is not an indication that drainage should be carried out proximally. The greatest tenderness is over that part of the sheath most affected, and the joints nearest to that part are the ones most limited in their movement.

Recovery from this condition is *less* likely to be complete than from the streptococcal lesion. Adhesions between the tendon and its sheath, although they limit further spread at the time, subsequently limit recovery of movement, and the last few years have seen a complete reversal of the seriousness

of the two conditions. This is a staphylococcal infection in most cases, and it is now the more crippling, and requires particularly careful treatment.

Many cases are avoidable. Subcutaneous abscesses in the volar compartment frequently extend to the surface of the sheath, yet for a number of days the infection fails to spread through the synovial membrane. If, however, blind incisions are made through the lateral part of the soft tissue, it is only too likely that the knife will penetrate the unprotected sheath, and precipitate a synovial infection. Exploration of such abscesses must be made with caution, and every deepening of the approach must be under direct vision, in a dry field.

The practice of " decompressing " a cellulitis of the finger, by making a lateral incision into the volar compartment before pus had formed, is also sometimes responsible for precipitating flexor sheath infections.

Lacerated wounds of the volar surface of the fingers frequently open the sheath without damaging the tendon itself. Early surgical treatment, careful toilet, and the provision of immediate skin cover will ensure uninfected healing, and rapid restoration to full movement (p. 131). If they are neglected, localised but very destructive disease of the sheath and tendon may develop, and may ultimately indicate amputation.

Other cases attend where spread to tendon sheath from a subcutaneous infection is already established In most of them access will already be available, through an abscess cavity or after the removal of a slough. When this is so, lateral incisions in the classical situation are, of course, superfluous. Penetrating wounds of the sheath, also, may produce a localised, not a rapidly spreading abscess, and these in particular call for an early decision, because sloughing of a section of the tendon may rapidly supervene. If access is not indicated through the original wound, because it is healed, or because it has been a small one, it should be explored by a local incision, approaching the sheath from the lateral or medial side. The state of the sheath can then be examined by direct vision. In any of these, exposure may reveal irreversible damage to the sheath and a section of the tendon underlying it It has already been noted that spread to more proximal and distal parts of the digit is likely to be slow, and it can be arrested by surgical treatment of the causative lesion. This may have to include the excision of some superficial sloughing fibres of the tendon, but it is seldom—if ever—necessary to remove the whole thickness.

If a decision on treatment of the tendon involvement has to be made, it should err, if error there is to be, on the side of conservatism. It is impossible, at the stage when treatment of the acute lesion is demanded, to estimate the degree of recovery of flexion. Lesions of the middle segment and at the level of the distal interphalangeal joint may leave the proximal joint and sublimis action quite unimpaired, and may thus have little or no effect on the function of the hand as a whole (Fig. 60). Surgical toilet at the primary operation should therefore be concentrated on dealing with the soft tissue lesion, and

draining any localised sheath infection in its immediate neighbourhood. The rest of the sheath should not be disturbed. If physiotherapy to the healing and healed lesion fails to restore function, a decision in favour of tendon repair, tendon grafting, or amputation must be made. Such decisions are regarded as being beyond the scope of this present work, and the intention here is to do no more than advance the view that early assessment of this

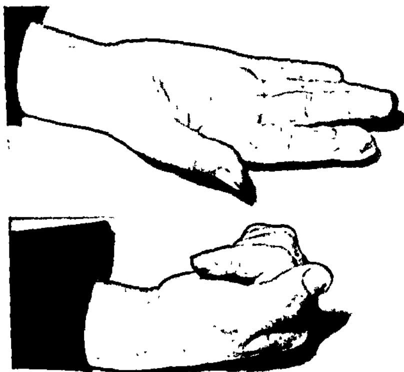


FIG. 60
Degree of movement possible three weeks after a localised sheath and tendon infection. Operative treatment was confined to the area actually affected The proximal joints have full function because a staphylococcal invasion of the sheath is usually soon contained by firm adhesions between tendon and synovial membrane.

condition tends to be unnecessarily gloomy, and that a conservative approach in all cases may allow the development of unexpectedly good results, at least in some. In particular, the casualty surgeon's immediate object is to overcome the infection, and in many it *is* possible for him to overcome it immediately. His second object is to obtain early skin cover. By the time these two are achieved he will have created the best conditions for return of function, and he may save many useful digits. Extensive drainage of the whole sheath when only a small part of it is affected, can do nothing but mischief.

The outlook in this condition, like that in many others, has improved vastly. Infection of the whole sheath—probably by the streptococcus—nearly always responds to antibiotic therapy without operation. Local (staphy-

lococcal) lesions are often avoidable, and although they are still responsible for much permanent limitation of movement, many of them will produce relatively good functional results from a direct approach to the affected segment by a conservative surgical technique.

CASE HISTORIES

CASE 1. A schoolgirl of fifteen pricked her finger with a sewing needle over the proximal interphalangeal joint. The next day it was painful and swollen. She reported to the casualty department, where it was found that the finger was slightly and uniformly swollen over the volar aspect and held one-third flexed. All movement was resented and resisted. Active movement was refused. The volar surface was exquisitely tender, most markedly at the proximal end of the sheath. The temperature was 98·8 deg. A diagnosis of primary tendon sheath infection was made. The hand was immobilised in a volar plaster slab, and she was treated with Procaine penicillin suspension 300,000 U. b.d. for the first two days, and 600,000 U. daily for the next three.

The exquisite tenderness, swelling and mild pyrexia resolved on this treatment, but at the end of five days she still complained of some tenderness over the whole volar surface of the finger, and it was still most marked at the proximal end of the sheath. Passive movement was resisted, and active movement would not be attempted. The improvement in physical signs determined that no surgical exploration was required Yet, *this was the first case in a series of similar cases* which had not entirely cleared up on this routine, and she was therefore admitted to hospital and given a course of chloramphenicol (500 mgm. six hourly for four days) Further observation at the end of this course raised a suspicion of hysterical perpetuation of the original organic complaint All splintage was removed, the physiotherapist resolved the residual symptoms in forty-eight hours, and recovery was complete.

CASE 2. A man of thirty-six was referred with a diagnosis of flexor sheath infection, complaining of five days' pain and swelling of the volar compartment of the middle segment of a finger. Pain and swelling were localised to this area. 50 per cent. passive flexion and extension were elicited without undue discomfort, but more than this provoked severe pain in the affected segment, though not elsewhere. On first attendance there were no signs of suppuration. He was treated with 300,000 U of penicillin suspension twice on that day, and the whole hand fixed in a splint with the arm in a sling. Next morning he announced himself more comfortable, but pus was present under the cuticle and it was clear that the previous days' assessment had been too optimistic.

Pre-operative penicillin was given as in the other cases. Under anaesthesia, with a sphygmomanometer tourniquet in position, the raised cuticle was cut away with sharp pointed scissors, revealing a skin slough in the midline 4 mm. x 3 mm, with pus oozing alongside. The slough was excised and pus mopped out. The cavity lay in the midline under the slough, and the base showed exposed flexor tendon covered only by its sheath. The cavity was cleared of all pus by dry gauze toilet, and pressure from the distal and proximal areas showed that no pus could

be detected in any part of the sheath, nor could any breach of continuity of the synovial membrane be demonstrated.

A dry dressing was applied and the tourniquet released. Penicillin suspension 300,000 U. were given the next day.

Dry dressings were repeated on the third day (when active movements were begun), the seventh, tenth and fourteenth days. The wound remained clean, and was scabbed over within the fortnight. Extension at the proximal inter-phalangeal joint was full. At the distal inter-phalangeal joint extension was limited by 45 deg. but was still improving. Flexion at all joints was almost full, and the tip of the affected finger could touch the palm.

CASE 3. A subcutaneous abscess over the distal volar crease progressed for a week before treatment was sought. Operation under the usual routine revealed a slough of the skin and subcutaneous fibro-fatty tissue, which was carefully removed. The tendon sheath was deficient in the base of the cavity and the superficial part of the flexor profundus was sloughing. The lesion was treated by removal of the involved tissue only, and no attempt was made to approach any other part of the sheath. Post-operative immobilisation by a splint to the whole hand, was maintained for five days. Three weeks after operation there was a small healed scab over the crease. There was no more than 10 deg. movement at the distal inter-phalangeal joint, but almost full movement at both the others. Further improvement was expected to occur in the next two or three months (Fig. 60).

CASE 4. A grossly neglected pulp space infection of the thumb attended the clinic approximately three weeks after onset. At this time the whole pulp was sloughing and discharging, and the subcutaneous and skin lesion extended from the tip to the distal of the two creases on the volar surface of the inter-phalangeal joint. It was clear that no good purpose could be served by operation as the infection had limited itself to this area already. Two days later large sloughs were picked out, leaving a cavity at the bottom of which lay the insertion of flexor pollicis longus. The tendon itself was sloughing superficially and the synovial membrane at this point had been entirely destroyed.

At no time did any other part of the tendon sheath (which extends from the septic area to the forearm) show signs of infection. Although the distal part had been grossly infected, adhesions of the synovium had effectively prevented further spread. Ultimately almost full flexion at the inter-phalangeal joint, and full function of the rest of the thumb, were obtained.

Suppurative Arthritis.—This, though a comparatively rare condition, even in clinics whose septic hand cases exceed a thousand a year, is to be considered with more than usual solemnity. The severity, the evil record of prolonged incapacity and the aftermath of fixed or painful members demand special attention. It is intended here only to discuss acute infection of joints of the hand, because suppuration in almost any other joint calls for In-Patient treatment. The joints about to be referred to are, therefore, metacarpo-phalangeal or inter-phalangeal, and the ways in which they can sustain an acute infection are many and varied.

lococcal) lesions are often avoidable, and although they are still responsible for much permanent limitation of movement, many of them will produce relatively good functional results from a direct approach to the affected segment by a conservative surgical technique.

CASE HISTORIES

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(p. 54), of making blind incisions into subcutaneous infection localising along the lateral and medial sides of the inter-phalangeal joints, and excessive use of the scalpel in exploring web space infections (Appendix III).

In assessing the aetiology of acute suppurative arthritis, mention must be made finally of the fact that hands already suffering from chronic arthritis are particularly prone to develop a superimposed infection from any of the



FIG. 61
A trivial cut led to a deep, sloughing lesion on the dorsum of the finger involving the distal interphalangeal joint The patient was aged 75 and the joint was already afflicted by osteo-arthritis. Amputation was refused The case was treated expectantly and sequestra were shed at intervals for ten weeks

above causes. The disruption of the proper joint coverings by long-standing disease removes much of the natural barrier to the spread of infection from adjacent tissue. The aged and arthritic, therefore, should be regarded with very particular caution, and an especially conservative attitude adopted towards them.

Even the more recent works on the surgery of the hand consider early amputation in cases of suppurative arthritis of the interphalangeal joints, and a good case can be made for such a radical attitude. It is not reasonable,

Penetrating and lacerated wounds provide a considerable proportion. Damage to the dorsal aspect of the metacarpo-phalangeal joint—usually the second or third—on the broken edge of an opponent's teeth during a brawl, may produce infection by a variety of organisms. It can give rise to a virulent, rapidly developing arthritis which, in spite of a battery of antibiotics, progresses to permanent articular damage and much limitation of movement. Neglected lacerations of the dorsum of the fingers, the depth of which has not been appreciated at the time, present three, four, or even more days later with a swollen, painful joint covered with dirty granulations oozing a thin purulent fluid. These also may run a long course with poor prospect of return to full function.

Such disasters can be avoided by careful wound toilet and precise repair, within a few hours of injury. If involvement of a joint is observed at the treatment of a lacerated wound, the best course to pursue is to concentrate on obtaining rapid and clean skin closure. Most digital joints will reconstitute some form of capsule, fashioning their own arthroplasty—even when there is articular damage—provided they are allowed an uninfected field in which to do so. One is wise to use an antibiotic prophylactically, even if quite empirically, though it has not yet been shown statistically that it is of any use.

Other cases of suppurative arthritis arise as a complication of septic fingers, and here again it is the late, neglected case which is in danger. Two types of soft tissue lesion are more particularly prone to it than the others.

Firstly, dorsal subcutaneous abscesses, often secondary to hair follicle infection, are a common source. Frequently a sympathetic effusion may be observed in the interphalangeal joint adjacent to a dorsal infection, and in some of these the effusion becomes infected. Sometimes a hair follicle infection may lie over the tendon covering the dorsum of the joint, and may spread directly into it.

Secondly, soft tissue infection of two adjacent segments, such as a cellulitis of the finger, may so impair the blood supply and infect the lymphatics that an underlying joint, and often a neighbouring section of the tendon sheath, become infected also, and a hopelessly involved digit is threatened. This is particularly the case with a neglected pulp space infection in which not only the distal two-thirds of the phalanx, but the base, and perhaps the head of the adjacent phalanx also, are in danger of sequestration (Fig. 66).

Joint infection from the dorsum and sides is commoner than infection from the volar surface because the latter must often be preceded by tendon sheath infection, and the symptoms of sheath infection usually demand treatment before further spread to the joint has occurred.

Unwise surgery in the treatment of simple septic conditions produces some cases, and in this connection one must note the danger of reflecting nail folds too far back when paronychia is treated by the Kanavel technique

often after the discharge of sequestra, to leave a joint with a limited range of painless movement, or an ankylosis (Figs. 61 to 63). An offer of amputation early in the disease may be made, but there is no economic pressure to urge the advantages of early healing and the offer is often refused.

Very careful judgment is required in the remainder, where it is determined to save the digit and it is required to obtain healing as quickly as possible, with a useful range of movement. Where the skin over the joint is in good condition, arthrotomy, with adequate antibiotic protection may be attempted. When the original lesion is unhealed, it may afford adequate access. This is particularly so if the extensor tendon has been severed or destroyed. In other cases it may be difficult to expose every part of the joint to direct inspection. Yet this must be aimed at, and a careful removal of all sequestrating fragments, and careful eradication of every scrap of granulation tissue are essential if rapid healing is to be obtained. In some cases, when one is satisfied that these essentials have been fulfilled, the wound may be sutured, or closed with a skin graft. Skin closure under tension is invariably doomed to failure. It has been reported that a buried silk suture of the extensor tendon itself may be tolerated without jeopardising the chances of healing by first intension.

The pus in suppurative arthritis of the inter-phalangeal and metacarpophalangeal joints loculates on the volar aspect, and a temporary dislocation may be necessary in order to explore this region fully. It is usually easy in late cases, because sequestration, or the laxity of the collateral ligaments, or both, have already made the joint unstable. In the early cases, at a stage when one hopes to avoid sequestration and joint disorganisation, it is much more difficult, and (particularly when the extensor tendon is intact) one may have to remove the granulations from the less accessible parts of the joint with a small hook.

Those which complicate gross infection of the terminal pulp space are often associated with sequestration of some of the distal phalanx, and in these an approach can be found through the cavity in the pulp. They are already committed to a considerable deformity of the finger end, but the dorsal part of the distal segment with the nail bed, can be brought over the cavity and used to obliterate it. This results in rapid healing, a small, transverse volar scar, and a hooked nail which protects the finger end and provides a more durable finish than an amputation scar. It also obviates the shortening which would be necessary if the head of the middle phalanx is removed to fashion flaps for a formal amputation (Figs 64 and 65).

When all aspects of it are considered, it must be confessed that the outlook in this condition is still far from satisfactory, and even when rapid healing can be obtained, a considerable degree of permanent limitation of movement must be anticipated.

In deciding for or against conservation one must make a reasonable assessment of the end result, and the points to consider are as follows:

however, to regard early amputation as the only form of treatment, and many factors have to be taken into consideration.

It should never be contemplated in the thumb. An entirely stiff deformed thumb, after months of incapacity, is infinitely preferable to no thumb at all, and every half-inch one can preserve is valuable. The argument that early amputation allows a rapid return to full earning capacity, which is often heard in favour of radical measures, cannot be applied to the thumb. It is doubtful if a thumbless workman ever returns to full earning capacity.

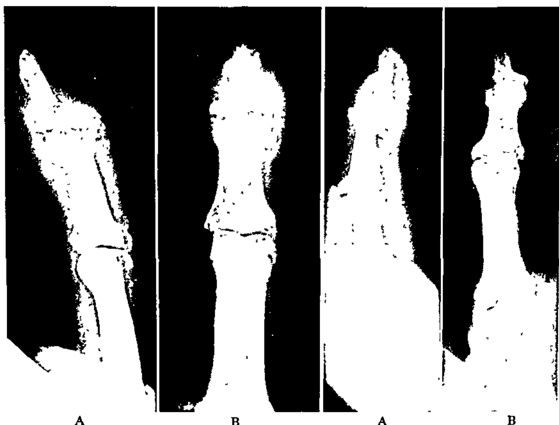


FIG. 62 FIG. 63

FIG. 62 Same case as Figure 61 X-ray appearance of sequestration in a chronic osteo-arthritic joint with secondary acute infection. FIG 63 Three and a half months later. Ultimately complete healing took place with a permanently alkylosed but painless joint.

It can be more confidently recommended in a little finger, and may be considered in other fingers with multiple septic conditions such as tendon infections combined with suppurative arthritis, or multiple joint lesions. Amputation in these cases should be by disarticulation. Section of the bone itself may lead to osteitis and sequestration in the stump. Any cosmetic improvements should be left to a second operation when all danger of reinfection has been outlived.

In suppuration supervening on chronic arthritis it may be advisable not to operate at all, especially if the patient is aged and in poor health. These cases run a protracted, painful course but can be certain of ultimate healing,

1. The little finger is worth little trouble.
2. The thumb is all-important.
3. Any other finger is useful but not essential.
4. A stiff middle finger impairs the function of the adjacent ones more than stiffness in any other finger.

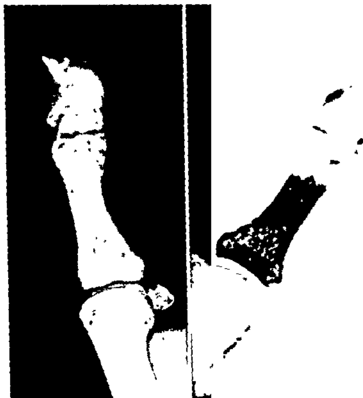


FIG. 66

X-ray appearance of an extensive subcutaneous infection of the thumb in the third week. Sequestration of distal phalanx, suppurative arthritis of the interphalangeal joint, and osteitis of the head of the proximal phalanx are established. This case was treated expectantly by immobilisation and penicillin.

5. In some occupations a finger which projects above the rest in the clenched fist is inevitably fated to suffer further injury. Loss of the finger may be preferable to loss of flexion

6. A successful arthrotomy may curtail the illness as much as four or five weeks

7 An unsuccessful arthrotomy will lead to amputation soon afterwards, because the condition flares up and surgeon and patient both agree to radical measures.

8. For a given amount of damage to articular surfaces, early skin cover results in much better mobility than is obtained after a long period of granulation.

9. Considerable recovery of function often takes place up to three or even six months after healing (Fig. 67).

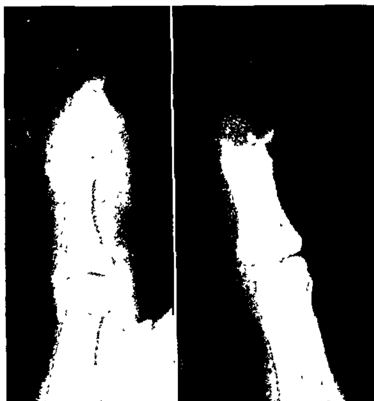


FIG. 64
X-ray appearance of a grossly neglected terminal infection, with almost total loss of phalanx, loss of much pulp tissue, and established suppurative arthritis.



FIG. 65
Same case as Figure 64 Eradication of the lining of the abscess cavity, and removal of remaining sequestra result in a collapse of the soft tissue and rapid healing. The hooked nail developed into a strong and useful protection to the finger-end It gave a better functioning end result than an amputation would have done

terminal scar became painless. Movement at the interphalangeal joint was one-half of normal two months after discharge (Figs. 67 and 68).

CASE 2. A mentally defective, unemployable cripple was referred with a three weeks' history of untreated septic little finger (Figs. 69 and 70), and the diagnosis included:

1. Infection of middle volar compartment, with much sloughing.
2. Underlying localised secondary flexor sheath infection, with superficial tendon sloughing



FIG. 68
X-ray appearance on the morning Figure 67 was taken, showing almost complete reconstitution of bone after sequestration.

3. Suppurative arthritis of the proximal inter-phalangeal joint.
4. Osteitis of the middle phalanx, with pathological fracture.

The finger was disarticulated through the metacarpo-phalangeal joint and the wound was healed in nine days.

The Streptococcus.—No more fitting illustration of the fundamental changes which have come over the casualty department in the last twenty years could be provided than by a consideration of the streptococcal lesion. At the beginning of this period a streptococcal infection (" blood poisoning ") was regarded with the gravest alarm. Amputation of the arm was a not infrequent sequel to a streptococcal infection of the hand. The mortality was not negligible. Many clinics regarded the appearance of lymphangitis as an indication for admission to hospital. Streptococcal infection of a tendon sheath almost always led to permanent and often severe disability.

CASE HISTORY

CASE 1. A man attended with an eight days' history of a septic thumb, in which infection of the whole thumb pulp, and infection of the distal half of the proximal segment, had produced multiple sinuses, leading to extensive sloughing of the lateral part of the pulp space, a secondary paronychia, and some sloughing of the fibro-fatty tissue on the lateral side of the inter-phalangeal joint. Operation consisted of exploration of the cavity, removal of slough, and removal of part of the nail for paronychial spread.

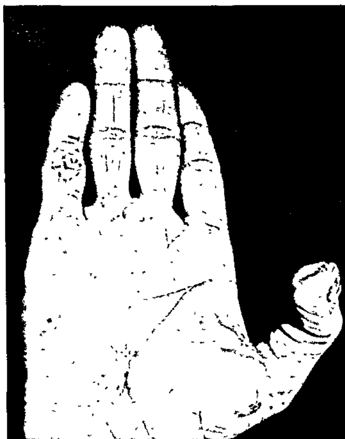


FIG. 67
Same case as Figure 66 Two months after discharge, showing maximum flexion. Extension was full. The terminal scar was painless, and the deformity of the pulp tissue is more acceptable than an amputation through or proximal to the joint.

Serial X-rays showed extensive necrosis of the distal phalanx and a patch of rarefaction on the head of the proximal phalanx suggesting joint involvement (Fig. 66). On the twenty-second day instability of the joint was elicited Four days later gentle pressure on the volar surface of the soft, swollen joint caused the discharge of about $1\frac{1}{2}$ c.c. of pus from the central sinus, and from this time the arthritis began to subside. A granulating cavity persisted for a further two weeks. A sequestrum was discharged on the fifty-eighth day. The total course of disability was nine weeks. The thumb maintained its original length, and the volar and

the infection demands treatment before attempts at localisation can be made, and because of the characteristics of the streptococcus, adhesions, sloughing, and gross destruction of surrounding tissues do not occur, and recovery of function is complete.

These characteristics also account for the fact that penicillin resistant haemolytic streptococcus is extremely rare[3].

It is not exactly correct to assume that spreading cellulitis and lymphangitis are always due to the streptococcus, and that all localising lesions are staphylococcal. Cellulitis, in particular, is frequently staphylococcal. So is impetigo. Many localising lesions (p. 50) are due to the streptococcus in association with the staphylococcus. It is not, from the clinical point of view, *necessary* to be correct on this matter, provided that the inference is appreciated—namely that the spreading lesions can be controlled by antibiotics and rest alone, but the established localising lesions usually require surgery as well. Whether the former are all streptococcal and the latter staphylococcal is of little practical interest.

It has been indicated that the routine use of penicillin in septic conditions requiring surgery calls for no more than two days' exhibition, provided that operation is carried out under a high concentration of penicillin and that it is designed to evacuate all the pus and all the infected granulation tissue. On the other hand, where abortion of the infection is anticipated, a more prolonged course may be required. Penicillin therapy may also have to be repeated or introduced at a late stage if lymphangitis appears during the treatment of the more prolonged lesions. The streptococcus is an occasional secondary invader, but here, as in its primary infections, it responds to penicillin in three or four days.

Lymphadenitis.—The infrequency with which lymphadenitis proceeds to suppuration has been mentioned when discussing the aetiology of axillary abscess (p. 15). Many septic hand cases complain of pain in the elbow region or axilla. So long as penicillin is used in the treatment of the causative lesion, and the latter is dealt with promptly, it is improbable that the inflamed glands will require particular attention. Thousands of septic lesions of the hand and forearm may be treated without the occurrence of a single indication for operation upon the glands at the elbow or axilla.

Restoration of Function.—The co-operation of the physiotherapist is essential in the efficient function of a casualty department (p. 240), but the number of calls on her services must be reduced to a minimum. Much can be done during the routine clinics to maintain or restore function after septic conditions. Errors of co-ordination are easily developed, and as easily corrected in their early stages. The surgeon who is aware of their characteristics can avoid weeks of " electrical treatment," massage, exercises and other

[3] A case of penicillin resistant haemolytic streptococcus has been reported to the author, from another hospital, but it has never occurred in his own casualty department.

The incidence of cases coming up to hospital for treatment of lymphangitis itself is now very low. Lymphangitis occurring together with a local lesion of the hand or foot occurs rather more often, but such a complication almost always resolves promptly during the administration of penicillin, and nowadays one hears much less frequently of a case of disseminated acute inflammation which requires In-Patient treatment.





FIG. 69 FIG. 70

FIG. 69 An extensive neglected suppuration in the little finger, involving the tendon sheath, the middle phalanx, and the proximal interphalangeal joint The treatment for most of such cases is disarticulation. FIG. 70. Same case as Figure 69 The X-ray appearance

It is this almost complete disappearance of the hazards of the rapidly spreading lesion which has allowed clinical concentration on the localised abscesses, and which has led to such dramatic improvement in their treatment. In the old days the streptococcus caused such disasters that to diagnose a lesion as " only a staphylococcal infection " was an expression of relief, and " only a staphylococcal infection " obtained correspondingly less consideration.

The very characteristics which led to streptococcal lesions acquiring such menace have, in fact, led to their easy annihilation. The streptococcus is a rapidly dividing, rapidly invading organism, outstripping all attempts at localisation on the part of the host. Because it is rapidly dividing, it provides frequent opportunities for an antibiotic or chemotherapeutic agent, parenterally administered, to act upon it. Because it is rapidly spreading, it offers a widely extended front upon which the therapeutic agent can act. Because

dressing on the first post-operative day. This is more painful than on the third or fourth, and the majority do not consider the discomfort is worth it.

It was the custom in this clinic to encourage detailed movements, exercising individual joints serially, until it was appreciated that in some patients attempts to produce active movements of individual joints resulted in the remainder of the hand adopting bizarre attitudes, and attempts to obey one's instructions, especially in the more earnest but less gifted individuals, produced violent muscle contractions up to and including the shoulder joint



Fig. 72

Valiant but misdirected efforts to produce active movements in the fingers. The effort involves the whole body. Flexion in the sound fingers is unnatural, is overstrained, and is associated with contraction of the extensors

(Fig. 72). The essential feature of successful return of function is to demand only natural movements in active exercises, and the common natural movements in the labourer's hand are

1. Using his knife and fork (for the muscles supplied by the ulnar nerve).
2. Opening and closing his fist (for the rest).

Opening and closing the fist can be attempted even if the finger or part of the hand is bandaged, and therefore, at the first post-operative dressing active attempts to restore this combined but simple movement can be demanded.

measures by a few minutes' attention and a few words of advice at the first sign of trouble.

He must be prepared to accept that his patients are, for the most part, entirely unschooled in the finer points of anatomy and physiology, as they are in the finer points of verbal communication. The command "Bend your fingers!" first evokes one of two responses, with almost equal frequency: either, an attempt at extension, or the retort "Which way?"



FIG. 71
A cheap and useful splint for the immobilisation of the whole hand in the conservative treatment of infections.

Deformed joints, adherent tendons, and contracting scars are not the commonest causes of temporary limitation of movement in septic hands. The commonest cause is a painful finger wrapped up in a bandage. One almost blames the bandage more than the pain. The movement of three fingers while the fourth is stiffened with a dressing produces a disharmony in the hand which sets up a vicious circle. Active attempts to keep the affected finger out of the way make the circle more vicious still.

In the early stages of inflammation attempts to resolve or localise the infection require rest to the whole hand. It is fixed on a splint in the position of function. Fixation of individual digits or part of the hand, though sometimes indicated in bone and joint lesions, is unwise in septic hands and is calculated to produce an incoordination. If rest is needed, it should be rest to the entire member (Fig. 71).

At the end of the first stage, resolution has taken place, or localisation has led to operation and sterilisation of the abscess cavity. A dry dressing applied to the wound before the tourniquet is removed becomes a dried blood splint twenty-four hours later, and fixity of the affected digit is thereby continued until the first dressing. Splintage after the operation is usually *not necessary, and because the operation relieves all inflammatory pain,* movement of the hand as a whole, so far as the bandage will allow, can be encouraged very soon afterwards. When the operation dressing is changed is the time to insist on restoration of function, in spite of the necessity to continue with a bandage. Because of this, some clinics change the operation

use his knife and fork properly, and exercised for a few minutes in the clinic at each attendance.

The hand should always be exercised when supinated. Flexion of the wounded hand with the palm downwards seems to encourage flexion of the interphalangeal joints with *extension* at the metacarpo-phalangeal joints. The command "Bend your fingers!" results in the same unnatural and painful movement. Supination, with "Make a fist!" has a better chance of success (Fig. 73). Even so, a definite demand to move at the knuckles—the metacarpo-phalangeal joints—may be necessary, and movement at the knuckles must be insisted upon. Once the rhythm is restored, the affected finger may be expected to take its place with the rest, and the individual interphalangeal joints will flex and extend in their proper order. The rhythm should be restored at the first sitting if possible, even though full flexion cannot be obtained at that time; and it is worth while holding up a clinic for five minutes or more in order to succeed. Thenceforth regained confidence may be expected to encourage efforts at home, and reinforcement at the next attendance is seldom necessary—but always given.

It is not suggested that this simple routine will be found adequate for the rehabilitation of all hand lesions, nor that the casualty officer should supplant the physiotherapist. Nevertheless, if it is applied early to all hand cases as a routine, it will avoid the development of many functional disorders, and cut down the demands upon a very expensive and very frequently overworked department. Once a neuro-muscular dysfunction is established—and it can arise from the most trivial conditions—a long and sometimes unsuccessful course of rehabilitation may be required. To diagnose and correct it in the early stages costs no more than an extra few minutes' devotion.

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Much higher in the evolutionary scale than the labourer, come the semi-skilled and skilled artisans, the musicians, typists, surgeons, watch-makers, conjurors, and so forth. They use their ulnar as much as or more than their median nerve. The small muscles of their hands acquire paramount importance. Yet they also, in the early stages of recovery, need no more than the flexion and extension of the digits, and exercises to the fist will set the



FIG 73
The hand should be exercised when supinated Dressings are reduced to a minimum Movement at the metacarpo-phalangeal joints is the most important to loosen up the fingers The most effective command is "Try to make a fist!"

hand back upon its proper road to recovery. Amongst them also, incoordination may appear quite quickly, but it is usually more easily corrected, and advice and instruction are more quickly assimilated. The skilled movements will follow naturally, once the simple ones are re-established.

For all patients, therefore, the second stage is devoted to getting *all* the fingers to work together, just as the first stage is devoted to getting them *all* to keep still.

At the end of the stage of immobilisation, it is explained to the patient that the period of rest is over, and that it is now important to "get things going again." (It is valuable to explain this because without explanation the patient may reasonably consider such a change of front indicates that the surgeon does not know his own mind) The patient is then advised to

in the vicinity, with infection of clean wounds and cross infection of septic ones. Swelling of the cuticle tends to cover the surface of the wound, to obstruct the escape of discharges, to predispose to loculation and relapse, and to provoke subcuticular spread of infection (p. 30).

Waterproof dressings produce maceration of the underlying skin and consequent delay in healing. The minor household cuts and scratches which are treated with these proprietory dressings gape, remain painful, and take three or four days longer to heal. To be able to carry on for nine days with a waterproof dressing is preferred to keeping a cotton bandage scrupulously dry for five. One can produce no convincing argument against this attitude, but one must recognise that if a dressing is waterproof enough to keep moisture and incidental infection out, it will keep perspiration and the normal skin flora in. Maceration and the danger of infection still remain.

In the rather more serious lesions treated in casualty departments there is no place for waterproof dressings. Porous gauze coverings are essential. The thickened cuticle around volar lesions must be kept trimmed well back, and the thin cuticle raised around dorsal infections must be clipped away at the operation and at every subsequent dressing (p. 31), until further spread is checked.

Sensitisation Eczema.—Damming back discharges, and the application of dressings which result in infective material spreading over and soaking into the surrounding skin, have more untoward results than maceration and the disadvantages thereof. The skin often becomes sensitised to these discharges and an allergic dermatitis spreads from the septic area (Fig. 74). In some cases a generalised skin condition sets in, and this may prove outstandingly intractable. Minor degrees of the local condition are not infrequently seen, and sinuses or granulating areas develop a spreading, red, swollen, irritable weeping surround which adds materially to the patient's discomfort and to the length of his disability (p. 116).

Prevention of this condition, as of all others, is better than cure. A technique which reduces all suppurative discharges to a minimum, with emphasis on primary healing where it can be obtained, avoids the majority. Many of the remainder can be avoided if the use of petroleum jelly gauze is reduced to a minimum. What little petroleum jelly gauze is used should be applied according to a definite procedure (p. 194). The application of ointments over discharging lesions and their neighbourhood is another aetiological factor, and they should be regarded with distaste.

Where infective discharges are unavoidable, porous absorbent dressings, with open wove bandages, are indicated. If there is danger of discharge spilling over to the surrounding skin, *frequent change* of dressing may be required (but see p. 193).

If sensitisation eczema is established, all discharge should be carefully dried away from the surface, and it should then be protected with Lassar's

CHAPTER IV

SKIN CONDITIONS

A KNOWLEDGE of dermatology is of great value to a casualty surgeon (as it is to anyone else), but his dermatological practice should be confined to the prophylaxis and treatment of those skin conditions which are associated with his cases of minor sepsis, and to a co-operation with the dermatologist in such cases as require minor surgery at some stage of their history.

A casualty department which is unable to call upon the services of a dermatologist is in a most unfortunate position.

It is useless operating upon subcuticular sepsis if it is the result of a pompholyx affecting the rest of the finger and much of the hand, or upon an infection of the nail sulcus if it is repeatedly reinfected by picking at a patch of impetigo on the face. The cause must be determined and the whole condition treated. If the local sepsis remains when the rest of the dermatitis has cleared up the casualty surgeon may undertake further treatment; but usually everything heals together. If a wart is the centre and cause of a subcutaneous inflammation it may be regarded as within the province of the surgeon, who might as well curette the wart if and when he has to operate on the abscess. If the wart is uncomplicated the dermatologist will touch it with liquid nitrogen and abolish it more swiftly and less expensively than could be done in an operating theatre.

It is impossible—and unnecessary—to enumerate the occasions when co-operation and consultation between these two departments is profitable. Suffice it to say that in an analysis of the work done in a casualty department, reference of cases to the skin department took second place only to reference to the fracture clinic.

Maceration.—The appearance of skin soaked in moisture for long periods is well known to everyone, and is so common as to be accepted as a normal variant. The dead white swollen surface, with every wrinkle twice as deep, and every ridge twice as high, rapidly develops, if evaporation from the surface is prevented Evaporation may be prevented because the area is constantly bathed in lotions or discharge, or because the skin has been covered with occlusive dressings, or both.

The whole question of dressings to open wounds will receive more detailed discussion at a later stage (p 192). It can be said here, however, that it is now firmly established (though not sufficiently realised) that dry wounds heal more rapidly than moist ones. Maceration of the skin at the edges of an incision, an ulcer, or a sinus results in rapid multiplication of all organisms

patient may remain sensitive for a long time afterwards, and a single re-application may be enough to provoke a relapse. Nurses sensitised to antibiotic powders may have to avoid contact ever afterwards, and in a few it has been necessary to advise an alternative occupation.

Certain patients are inherently sensitive to one of the constituents of "elastoplast" and any reaction from it contraindicates its use. Many of them are aware of their condition from previous experience, and if the surgeon is informed of it the warning should not be neglected. Those who are unaware of it should be informed of the peculiarity so that they can warn any practitioner they may subsequently attend and so avoid a relapse.

An occlusive dressing over tincture of iodine *frequently* produces a fierce reaction which may take many days to heal.

Sensitivity to Antitetanic Serum.—The local and general reactions to injections of antitetanic serum are well known Every patient given such an injection should be told what it is so that he can report it if he has a second accident soon afterwards. More frequent injections than once in six months are not necessary, and much of the danger from allergic reactions can be avoided.

A swollen arm with a patch of inflammation of the skin and subcutaneous tissue is not uncommon. It seldom leads to suppuration and does not usually need any treatment. Some " batches " of antitetanic serum are more to blame than others, and if many reactions occur at one time it may be justifiable to jettison an issue. There is no evidence that injections producing a fierce reaction confer a higher degree of immunity than the less troublesome ones.

Patients who suffer from other allergic conditions (asthma, hay fever, urticaria, eczema) are more likely to react to A.T.S. injections, and they may be given " ephedrine " or " benadryl " three-quarters of an hour before their injection

Sensitisation to Penicillin.—If a patient reports that he is " sensitive to penicillin " he should be further questioned. It may be established that his " sensitivity " is of the type already described—that is, he has at some time developed an eczematous reaction to a topical application. This does not necessarily mean that parenteral penicillin will produce untoward effects, but some of those who have acquired susceptibility to penicillin as a result of local application may be thenceforth reactive to penicillin in all its forms. It is particularly unfortunate that many of these patients have been given a penicillin cream for some trivial superficial complaint and are afterwards denied the superb value of parenteral penicillin for a more serious condition.

Urticarial reactions are occasionally seen soon after the injection of penicillin whether the patient has had any sensitisation to topical applications or not. Patients with a history of other allergic reactions should be given " ephedrine " or an antihistamine drug, while penicillin therapy is in progress, and a decision whether to use penicillin at all may be influenced by

paste and soft paraffin (equal parts) which must not be applied to the septic area itself. The septic area is still dressed with absorbent gauze as described above. Vigorous attempts to obtain healing must be prosecuted and the daily dressings repay the extra effort.



FIG. 74

in this case in a few days when porous dressings replaced the elastoplast used to fix the grafts.

Sensitisation to Topical Applications.—A similar condition affects the skin surrounding a septic lesion after the local application of certain agents Sulphonamide powder, penicillin powder, and streptomycin powder (the last especially) are all responsible in certain subjects. Nurses who frequently insufflate such lesions may themselves suffer, especially on the dorsum of the hands and about the eyelids. Ointments made up with these agents are also, and perhaps more particularly subject to the same disadvantage. Unless the cause is recognised and removed, cure cannot be expected, and some cases persist for a long time after the cause has been removed. Moreover, the

CHAPTER V

UNCOMMON SEPTIC CONDITIONS

IT is not proposed to enumerate all the uncommon septic conditions which may present themselves at a casualty department because the possibilities are almost infinite. Sufficient illustration that *anything* can happen is afforded by the report that the morning on which this page was written saw the appearance of a patient with a septic wound in a hand already afflicted with leprosy. Nevertheless, certain conditions may be expected to appear at infrequent intervals, but which show a fairly steady incidence through the years, and of which one must always be aware. Most of them have already received adequate descriptions in standard works (especially Bunnel, Surgery of the Hand), and it is not proposed to repeat these descriptions, save where it is necessary to put them in their proper focus, and to indicate which of them are *moderately* rare rather than extremely so.

Rarities may, in fact, be roughly divided into those one ought to detect, and those one might miss without embarrassment. It is with the former that this chapter is particularly concerned.

Chronic Paronychia.—There is considerable difficulty in defining this condition. It has already been said that there is great variation in the rate of development of nail fold infection in different cases. Some (especially those where infection is confined to the subcuticular plane) may rapidly proceed to the involvement of the whole nail and a considerable area of the surrounding skin. Others localise quickly and the pain of the developing subcutaneous abscess demands treatment. The subcuticular variety may rupture early. If so, what pain there is diminishes, and the condition, if uncured, may settle into a state in which subungual infection waxes and wanes, with a little inflammatory flare-up from time to time. Short episodes in which the nail fold discharges are interspersed with periods of comparative quiescence. These cases have usually been treated with frequent applications of ointments and lotions to the superficial surface. In between treatments the hands have been steeped in water and detergents in the ordinary course of household duties At the best the nail fold becomes sodden and macerated, and the base swollen, tender, and mildly inflamed. It hangs away from the nail, and around it can be expressed a little whitish cheesy material—pus and broken down skin products mixed together. At the worst a sensitisation eczema is superimposed upon this condition, caused by the topical application of sulphonamides or antibiotic ointments; and the allergic dermatitis may become generalised (p. 76)

the response to an injection of 100 units of penicillin intradermally. Mild urticarial reactions are treated orally with " anthisan " 100 mgm. b.d. or t.d.s. for forty-eight hours. The attack seldom lasts longer than this. There is no connection between the type of penicillin preparation used and the liability to reactions, except that a few patients are sensitive to the procaine moiety in those preparations containing it.

They are sometimes accompanied by other signs of anaphylaxis—oedema of the face, respiratory distress, or precordial pain. More rarely, collapse and unconsciousness. and in a few cases death, have been reported. All these more alarming cases have had penicillin injections before, and in many (though by no means all) previous injections have been followed by reactions of less severity. Antihistamine injections (" benadryl " intravenous, 30 mgm., or " anthisan " subcutaneous, 50 mgm.), are recommended as emergency measures, and are considered to be more efficacious than adrenalin.

Increase in the use of penicillin is accompanied by an increase in the incidence of reactions, but this is no justification for the suggestion, sometimes put forward, that penicillin should be abandoned in favour of a newer antibiotic Penicillin remains the most valuable of all the antibiotics in casualty cases. Nevertheless, it is becoming evident that an enquiry of all patients, whether they have had penicillin before, and if it caused any trouble, is a wise precaution, and it should be associated with an enquiry on other allergic manifestations. In suspicious cases the skin test is indicated. In the " allergic " type of patient " ephedrine " or " antisan " before injection should be given. In many who are known to react to penicillin, or those with positive skin tests, the decision to use it should be reviewed. Most patients in casualty rooms can be treated without antibiotics by standard methods, for antibiotics are nearly always used as valued assistants rather than necessities. Where antibiotics are regarded as essential, the oral use of chloramphenicol is usually the second choice, at least in so far as the staphylococcal infections are concerned.

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promise may have to be made, and some successes can be obtained if the patient is allowed the use of a rubber finger stall for short periods to complete necessary duties, with an immediate change of all dressings once the duty is completed; but liberties of this sort are almost invariably abused.

Mild cases, where the lesion is confined to a small area (usually one corner of the fold) can be cured by carbolisation of the affected area with an orange stick and a wisp of cotton wool. Any applications calculated to give rise to or perpetuate sensitisation must be forbidden. More extensive cases require the repeated application to the nail fold of an antiseptic made up in spirit. The essential part is the spirit, and the choice of antiseptic varies. Brilliant green is popular, gentian violet and other preparations are used. Ointments and watery preparations are alike contra-indicated at this stage. Persistence with these measures will bring a cure in the majority of cases, but the application may have to be continued for five or six weeks before it can be certain that healthy nail is growing again.

Malachite green:

Hydrarg Perchlor . .	$\frac{1}{2}$ per cent.
Brilliant Green . . .	$\frac{1}{2}$ per cent.
Spirit	99 per cent.

—is probably the best application to use.

Such forms of therapy are in the province of the dermatologist and he is better equipped to treat chronic paronychia in nearly every case. On the rare occasions when he fails the surgeon may be required.

This approach makes it clear that, although there is difficulty in dividing nail fold infection into two distinct classes, some attempt must be made because the treatment of acute paronychia is surgical in the first instance, and the treatment of chronic paronychia is surgical only in the last. Between the two extremes lie an indeterminate group in which, the more the case approximates to the chronic type, the more one is inclined to try dermatological measures before operation. Operation, therefore, is usually reserved for those cases which have had at least one unsuccessful course of more conservative treatments. When it is decided upon, the base of the nail is taken away, together with any other part of it which is brittle, deformed, softened, or split. A very careful excision of all white and swollen, or loose, or moist fragments of cuticle is carried out, from the skin around the nail, from the sulci, from the nail bed, and particularly from the under surface of the nail fold. It must be performed under a tourniquet, and in a good light. All affected nails are done at the same sitting, to avoid reinfection should fungus be present. Scraps of the cuticle are examined for mycelia. The nail fold is painted with the spirituous solution, and a wick of gauze soaked in the same is lightly packed into it. The penicillin routine is adopted in case there is a staphylococcal growth.

It has been proposed that an arbitrary division should be made on a time basis—under fourteen days' history should be classed and treated as acute paronychia—fourteen days and over as a chronic. However, no arbitrary time can be satisfactory, because the time factor in paronychia is even less constant than in other septic conditions, and because making a diagnosis on nothing but the length of history puts too much dependence on the observation or the memory of the patient.

The relationship between this condition and fungoid infections is not well established. It is possible that some of these cases become secondarily infected with fungus and that the original cause is an acute infection. It is possible that the opposite sequence of events is just as common. From many long-standing cases staphylococci are the only organisms grown on culture The routine examination of skin fragments removed at operation shows mycelia in rather less than half the cases one has diagnosed as "chronic" from the clinical appearance. No clinical difference may be detectable between those in which mycelia are identified and the others, but the affection of more than one nail in the same patient at the same time is suspicious of an epidermophyte. Mycological diagnosis is a highly specialised branch of pathology and the percentage of positive results depends to a large extent on the available facilities.

The distinction between acute and chronic paronychia can never be precise, but if it is made on the clinical appearance it will be, to some extent, a reflection on the pathological processes involved, and will be some guide to the type of treatment likely to be successful. Whether the fungus is, or is not identified then becomes of secondary importance.

When the nail fold can easily be lifted away from the nail, and the characteristic whitish discharge is expressed, maceration of the cuticle about the base of the nail bed is usually present. Maceration may also affect the cuticle around the sulcus or nail fold. This decomposition of the superficial layers of cuticle has been referred to in its own context (p. 74), but it requires consideration again here because it is probable that the addition of this feature to that of infection makes the practical difference between a chronic and an acute case. The presence of decomposing epithelium under and about the nail is a potent cause of persistence of infection. It is the main reason why the standard operations for acute paronychia, if carried out on these cases, show a very high proportion with delayed healing or recurrences.

The first essential in all forms of treatment is to demand that the affected finger or fingers be kept dry. Much of the chronicity is due to the habit of continuing washing-up and vegetable-peeling with a sodden rag around the lesion. Even the habitual use of rubber gloves for housework is little better. Perforated gloves are no use because they are perforated, and intact gloves are worn for too long and the lesion becomes moist with perspiration. It must be impressed upon the patient at the outset of treatment that any compromise on this point will militate against a successful result. Com-

wart. It may steadily—sometimes (after a quiet period of some months) rapidly—increase in size, and become painful, pedunculated, easily damaged, or covered with a superficial slough. The skin around it becomes delimited, as it does around a wart, with a slightly undermined edge. If it is excised the histologist may erroneously describe it as a haemangioma. It is not necessary to excise it. It is a chronic staphylococcal lesion. It can be cured by a touch with a diathermy needle, or, if somewhat larger than is amenable to this, by curettage and carbolic acid to the base. It is well known to the dermatologist, less so to the surgeon (Fig. 75).

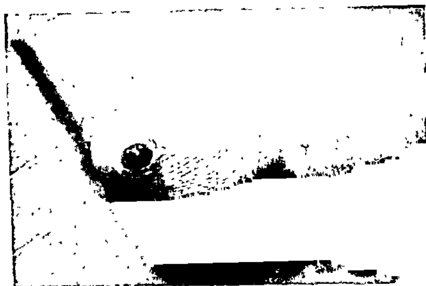


FIG. 75
Pyogenic granuloma.

Erysipeloid.—Attention has been directed to this condition on a number of occasions in the last few years, and it is becoming rather better known than hitherto. It was first described many years ago, but it is still quite frequently missed. Its incidence in any series of septic hands approximates to a little under 1 per cent.

The classical description (" erythema serpens ") is of a bluish-red, irritable swelling of the true skin, with underlying oedema of the subcutaneous tissue (which never proceeds to suppuration, and never requires incision). It slowly extends from a focus which is usually a scratch or small wound. Its habit of creeping " up one finger and down the next " though described as characteristic, is not fixed. Sometimes the spread is on to the hand and up towards the wrist. It is said never to encroach upon the forearm. Nowadays opportunities to observe its limits do not occur, for it is sensitive to penicillin, especially if treated in the first week. It has a self-limiting history of about four weeks, but penicillin cuts this down to a few days.

Each day after operation the nail fold toilet and a dye application are repeated, until the time comes when all the area holds the dye applied at the previous dressing. The open wound at first absorbs the dye, and the early dressings show a dry, dyed area surrounding a pink granulation. When the pink area is no longer seen healing has occurred and it can therefore be determined promptly.

Avoidance of maceration while the new nails are growing will give a good prospect of permanent cure.

It is seen that this surgical and dressing procedure is somewhat formidable. The dressings, especially of multiple lesions, may develop into a painful ordeal. The prospect of putting both hands out of commission for a number of days is serious to the majority of patients. Nothing less than *this, once operation is decided upon, can be expected to* avoid a high proportion of recurrences. Failure of persistent dermatological measures is the only justification for it, and it is required only in the most intractable cases.

Case History

A housewife was referred by a dermatologist for surgical treatment of multiple nail bed infections. This patient had suffered from recurrent inflammation with discharge for *eight years*. She had repeated applications of X-ray, had been treated energetically with Carbol-Fuchsin dressings and courses of parenteral chemotherapy The middle and ring fingers of both hands were affected. Thumbs *and indices were free, but the little fingers were said to be affected occasionally.* At the time of attendance there was no sign of infection in the little fingers. The appearance of middle and ring fingers corresponded with the description already given The type of operative and post-operative treatment of the four nails has already been described in the text. Castellani's paint (Pig. magenta Co. B P.C.) was used in this case, but no special virtue is ascribed to this particular application. It is, however, made up in alcohol diluted to 60 per cent., and early post-operative dressings of three or four fingers in 98 per cent. alcoholic solutions can seldom be tolerated.

Dressings were carried out at frequent intervals for the next fifteen days, at which time all the lesions were healed. She very faithfully refrained from any contact with water for three weeks. Eighteen months later there was no sign of recurrence, and the only aftermath was a minor nail deformity on one finger due to slight damage to the matrix

Mycelia were detected in the cuticle removed at operation.

Some textbooks of dermatology still recommend the total eradication of affected nail and nail bed in cases which resist local therapy. The surgical procedure described here should be carried out before such mutilation is contemplated.

Pyogenic Granuloma.—A patient may report that he has a spot on his finger or hand which bleeds repeatedly from minor abrasions and will not heal. It may have the appearance of a small red pimple, or of a rather soft

necrosis ultimately demanding high amputation. It has already been recommended (p. 61) that approach to cases of suppurative arthritis in osteo-arthritic joints should be very conservative, and it has been pointed out that the osteo-arthritic joint is very susceptible to superadded acute infection. Impaired superficial blood supply and osteo-arthritis often occur together. " Priscol " as a pre-operative preparation is valuable in some cases. So is admission to the warmth of a hospital ward. An operation in July may be contemplated when the same operation on the same patient has been refused the previous January. It may have to be refused altogether, and the aged patient has to be encouraged to tolerate a minor disability rather than face a major and possibly fatal disaster.

Septic Lesions in Diabetes Mellitus.—Improvement in the control of diabetes mellitus has marched step by step with improvement in the treatment of minor septic lesions, so that on both counts the outlook has brightened and conservatism is in the ascendant. Nevertheless, no carefree approach to this combination of diseases is justifiable. Stabilisation of the diabetic state is imperative before surgical treatment of the sepsis can be undertaken. It is still wise to arrange for In-Patient treatment in many cases.

Localisation of staphylococcal lesions is slower than in the healthy. There are still many cases of suppurative arthritis, especially arising secondary to infected callosities of the feet. Paronychia still requires most careful handling if spread to the dorsal subcutaneous tissues, and on to inter-phalangeal arthritis or digital gangrene are to be avoided. But the rewards of such careful handling come more easily, and in greater profusion If operation is necessary, proper antibiotic control of the infection, and hormonal control of the diabetes, may be expected to provide first intention healing of the flaps or stumps. Most important of all, high amputations for sepsis are now much less frequently indicated than used to be the case. It is reasonable to amputate, at least in the first instance, at the next proximal joint.

These remarks apply to septic conditions, which, because they occur in the diabetic, meet with little natural resistance from the patient. Antibiotics may be used temporarily to replace that lack of resistance, and to enable the surgeon more nearly to treat the septic lesion on its own demerits. The same observations do not apply with equal force to arterio-sclerotic gangrene in the diabetic, for one cannot hope to relieve interference with the blood supply by antibiotics. Precision in weighing up the case is demanded before a decision in favour of conservative or radical excisions can be made.

Because these patients are often admitted to hospital, and run a protracted course, their lesions are prone to develop penicillin resistant flora (p 8); but again, because they are in hospital, the accurate exhibition of oral antibiotics presents no problem. The increased ability to rest the inflamed part, which is afforded by admission to hospital, will often result in a

The classical picture is not always seen today, because penicillin has often been given before the case is referred, and one may have to make a diagnosis on the less spectacular residual discoloration, the diffuse soft tissue swelling, the history of irritation and stiffness, and the fact that stiffness in the nearest interphalangeal joint may persist for some months and give rise to disability. Some cases, in fact, are referred for the arthritis after all other signs have disappeared, and a diagnosis has to be made entirely on the history and the presence of a swollen joint.



FIG. 76
Bilateral sepsis associated with peripheral vascular inadequacy Operation without careful pre-operative preparation may precipitate spreading gangrene

Biopsy, though it has been carried out for research reasons, is wholly unjustified for diagnostic purposes. No surgical procedure whatever is required. The patient need not necessarily be kept from his work. All he needs, if the case is a recent one, is penicillin, in larger than the usual doses, once a day, for five or six days For the arthritis no more than active exercises and reassurance are prescribed.

The association with minor trauma in handling fish is still maintained, though some sources of infection are agricultural, and some altogether mysterious.

Septic Lesions in the Arterio-Sclerotic.—Gangrene of the foot in the aged is precipitated by minor trauma, and minor trauma includes surgical treatment of deformities and sepsis of the toes (Fig. 76). Some of the sepsis is, in fact, due to trophic changes, and operation upon it may lead to a spreading

CASE HISTORY

A middle-aged disobedient diabetic was admitted in diabetic coma and treated in the medical wards. She had already been in bed at home from an intercurrent infection and both heels showed discoloration. The diabetic condition was controlled but a patch of dry gangrene developed on each heel where recumbency had produced pressure. Before infection could set in both patches were excised down to healthy fibro-fatty tissue. On one side this necessitated removal almost to the periosteum of the os calcis. Split skin grafts were cut and inserted into the cone-shaped cavities. Dry healing occurred in both feet within fourteen days of operation.

Septic Lesions in the Vaso-Spastic.—The illustrations of digital gangrene from Raynaud's phenomenon, which are given in text books, are sufficiently vivid to impress themselves on even the most unimaginative. Its occurrence is seldom forgotten, and as seldom observed, for it is extremely rare. It is not so frequently remembered that the association of Raynaud's phenomenon with lesions less spectacular than this is not uncommon. The observation that digital circulation is fundamentally inadequate in a patient with a septic lesion may alter the approach to the case. To treat the lesion without taking this into account may lead to bad results.

The septic hand in a normal patient has an increased blood supply, and any signs of circulatory sluggishness should prompt an enquiry into previous symptoms of poor circulation. Sometimes the patient will volunteer that it is poor, especially in the winter or on exposure. Classically, Raynaud's is a recurrent phenomenon, with periods of complete normality in between, but some patients will report that their fingers are always abnormally blue and cold in the winter. These also, though not perhaps true vaso-spastics, are liable to similar complications of their septic conditions.

A clear distinction can be made between common septic conditions failing to heal because of the vascular disease, and conditions primarily arising because of the vascular disease itself. Circulatory inadequacy, in short, may be contributary to the condition, or causative. In the former class are all the common septic conditions of the fingers, and most especially paronychia. In the latter come the superficial trophic ulcers, which occur at or near the finger tips, and which may resemble paronychia very closely (Fig. 77).

Trophic ulcers, though they usually involve part of the nail bed, often have very little underlying subcutaneous involvement. The typical appearance is of a little black cap over the finger tip, one edge of it, perhaps, lying under the end of the nail. The cap is attached to the underlying subcutaneous tissue, and the latter, though blue and cold from inadequate circulation, usually remains viable *unless it is further traumatised by surgery*. The edges of the cap loosen in a few days, and become moist. If the circulation is improved sufficiently the rim will dry quickly but it may be many weeks before the hard crust is finally shed. If it is untreated the patch will separate

temporary improvement. It gives a respite of two or three days in which accurate bacteriological control of the case can be established.

Case History

A woman aged sixty-four developed local gangrene in the left foot in December 1951. The diabetic state was first diagnosed at this time but there was a history, extending back for two years, of polyuria, thirst, and loss of weight. A gangrenous patch developed about the outer side of the little toe following infection of a callosity There was much discoloration of the great and second toes but this disappeared with rest in bed and control of glycosuria.

In February a slough was removed from the outer side of the little toe and the cavity revealed an open interphalangeal joint. Subcutaneous extensions on the foot required drainage of the area on the planter surface of the heads of third, fourth and fifth metatarsals. The pus grew penicillin sensitive staphylococcus aureus, and penicillin was given in five-day courses 300,000 U. daily, three times in March and early April.

On April 10th the cutaneous destruction was well defined, the subcutaneous sepsis on the foot had been cured, and amputation of the toe, with sequestrectomy of the head of the fifth metatarsal, were carried out. The wound was roughly closed but continued to discharge until the end of June, when the last granulation healed over.

She returned in December 1952 with a septic lesion of the other foot. The left foot was well healed, the circulation over the stump was normal, and she had been walking average distances. However, a callosity on the right fifth toe began to break down and discharge. She was admitted to hospital and no operation was carried out until the slough had separated spontaneously. Her diabetes was controlled again.

Soon after admission a staphylococcus aureus was grown, which was insensitive to penicillin and chloramphenicol. Local applications of tyrothricin were used. A ward infection changed the flora (January 1953) to haemolytic streptococci (sensitive to all antibiotics) and coliform organisms (sensitive to all antibiotics except penicillin) This infection was kept under control by a course of chloramphenicol (500 mgm. six-hourly for five days), but the slough refused to separate and the toe continued to discharge. X-rays showed suppurative arthritis of the proximal interphalangeal joint, with adjacent sequestration On the 3rd of February the wound was clean and granulating, and a penicillin sensitive staphylococcus was then in possession. Disarticulation through the metacarpo-phalangeal joint was carried out, with pre-operative and post-operative high level penicillin routine. Healing was by first intention, and there has been no recurrence

This history is of a case which at one time might have been expected to progress much more extensively. Such a condition was even occasionally regarded as an indication for prompt high amputation. Now, with care for both sides of the clinical picture, it can be prevailed upon to heal with very little residual disability.

over the lesion itself is as good an application as any other. Very careful resection of any nail which is overlying the ulcer may help absorbtion of discharges by the dressing. Excision of the ulcer with skin grafting cannot be contemplated until the blood supply is restored to normal, for the risks of failure are great. A very reserved attitude is required on the part of the surgeon as well as the patient.

" Priscol " gives better results in the upper limb than in the lower, but its exhibition in all cases is worth while, and if operation is indicated, it can be undertaken with reasonable safety when the circulation has been improved. As implied above, trophic ulcers seldom call for operation, because they are usually superficial and heal with little residual deformity. If they are sufficiently extensive to demand reparative surgery, but not to require amputation, it should be delayed until more permanent improvement has been obtained. Cases may be kept on " Priscol " for long periods with little discomfort, but it may be preferable to wait for the weather, or for the results of a sympathectomy. If one of these courses is decided upon, elective operation on the extremity can be carried out when the sepsis is overcome.

The indications for and against operation on the sympathetic system cannot be put within the confines of a work on minor conditions; but an upper dorsal sympathectomy may, under certain circumstances, be the proper preliminary to an operation on a paronychia. Minor matters sometimes invite major decisions.

Tuberculosis.—An unobservant parent may give a misleading history (" we only noticed it this morning ") which results in incision into a *tuberculous dactylitis.* The resemblance of " spina ventosa " to a volar compartment abscess is only a superficial one, but such mistakes have been made. " Spina ventosa " is less tender, does not fluctuate, and has a history of at least two or three weeks. It does, however, produce limitation of movement and a swelling of the finger which may be red and warm. The swelling is in the first instance mainly of the soft tissue overlying the osteitis, and the expanding appearance of the phalanx on X-ray appears later. The treatment of election is by fixation, and a course of streptomycin, P.A.S., and isoniazid. (A child of seven was thus successfully cured by ½ gm. streptomycin, 7·5 gm. P.A.S., and 100 mgm. isoniazid daily for thirty days, and splintage for eight weeks.) The introduction of secondary infection by a mistaken incision may result in peril to a finger which might otherwise have been avoided.

Primary Tuberculous Lesions of the fingers or hand are uncommon, but have occurred three times in the last five thousand septic hand cases. In one of these attention was called to the condition by the early development of caseating axillary adenitis (p. 16). A subcutaneous or dermal ulcer which fails to heal under routine treatment should be suspected of tuberculosis, and biopsy of the edge should be carried out. This is more likely to allow a

entirely leaving an ulcer with an infected fibro-fatty base, and, where it involves the nail, pus may spread to produce a subonychia or paronychia in addition.

All degrees from this to gangrene of the whole finger may be found, but the rarity increases with the severity.

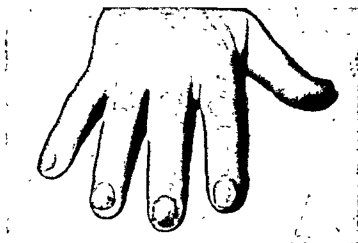


FIG. 77
The lesion on the middle finger was sent to the casualty department with a diagnosis of paronychia. The underlying vascular inadequacy must be recognised, because operation in this state may precipitate a spread of the tissue destruction This is a trophic lesion due to Raynaud's phenomenon A similar though less marked condition was present on the other hand. They should not be operated upon until the blood supply is improved, and then it is frequently unnecessary This case healed in ten days with the administration of "Priscol"

Similar trophic signs are described in vascular disease affecting the legs. Raynaud's phenomenon may occasionally occur in the feet as well as the hands, but the commoner (and increasingly common) condition which produces vascular inadequacy in the feet of the middle aged is thrombo-angiitis obliterans. Septic conditions of the feet, whose recovery is delayed by this, or trophic conditions primarily arising from it should be recognised. An assessment of the case from the cardio-vascular point of view is demanded before minor surgery on the local lesion is undertaken.

The perils associated with operation are the same as those in senile and diabetic arteriosclerosis, but the situation is less gloomy because the vascular disease itself is more amenable to treatment. "Priscol" frequently gives sufficient response for the trophic lesion or septic condition to heal, even if only temporarily, and gives a respite while radical sympathetic surgery can be considered, and any pre-operative investigations carried out. Trophic ulcers will usually heal if a rigid regime of protection from trauma and maintenance of warmth to the extremities is demanded. A dry sterile dressing

Contrasting Case Histories

CASE 1. A man of thirty-three attended with a fourteen days' history of painless swelling on the ulnar side of the hand. It was fluctuant and slightly reddened. Aspiration gave a little pus which was sterile. Examination for tubercle bacillus was negative; nevertheless a diagnosis of cold abscess was made. W.R. and Kahn were negative. The X-ray examination at this stage showed a non-specific periostitis of the fifth metacarpal bone. Biopsy taken a fortnight later confirmed the diagnosis of tuberculosis. The incision healed but the swelling increased and a month after biopsy the scar broke down and soft granulations developed. The X-ray appearances showed little change until the fourth month of the disease, when sequestration was apparent. At this stage, during a course of streptomycin which lasted three weeks, the lesion was explored, curetted, and the sequestrating head of the metacarpal removed. Repeated fixation in plaster of Paris followed for a further two months, and almost exactly seven months from the onset of the disease the lesion was healed.

CASE 2. A girl of eighteen was referred with a three months' history of swelling of the thumb. When first seen in the casualty department the soft tissue swelling had the superficial appearance of an acute septic lesion, with destruction of the skin over an area the size of a sixpence (Figs. 79 and 80). The X-ray film showed osteitis of the proximal phalanx not involving either of the adjacent joints.

The patient was given streptomycin 2 gm. daily and P.A.S. 15 gm. daily, for three days, and on the third day the lesion was explored. The cuticle was cut away, and access was improved by incision along the medial border of the thumb. Granulations involving the subcutaneous tissue were carefully curetted away. The flexor tendon in its sheath, and the periosteum on the volar surface of the phalanx were displaced together, so that the granulations extending into the marrow could be similarly treated. The flexor sheath was perfectly healthy. The incision was sutured without tension, and the remaining hiatus where the skin had been destroyed was covered with a split skin graft. A local pressure dressing was applied and the hand (including all of the thumb except the tip) put into plaster. Streptomycin 1 gm. and P A.S. 15 gm were given daily for a month after operation.

The plaster was removed, stitches taken out, and the skin graft dressing changed on the tenth day (Fig. 81). The wound was quite healed. Immobilisation in plaster was continued for the remainder of the first month (Fig. 82). Movement at the interphalangeal joint was slow to return but 50 per cent. of flexion was attained at the thirteenth week. Nine months after operation there was no sign of infection (Fig 83).

An occasional cause of a subcutaneous tuberculous abscess is infection of a Mantoux test, possibly from instruments contaminated by B.C.G. vaccine; or by the development of a low-grade tuberculous infection in a vaccine injection itself. The only case seen by the author healed by curettage and suture; penicillin was given but its value was doubtful. Tubercle bacilli were cultured from the tissue removed, but the case was cured before the pathology report was to hand and before a course of streptomycin was decided upon.

helpful report from the pathologist than sending a bacterial swab labelled "? T.B." (Fig. 78).

Verruca necrogenica, lupus vulgaris, and scrofula do not often show aberrant forms, and require no special comment here.

TUBERCULOUS TENO-SYNOVITIS (" compound palmar ganglion ") has well described characteristics, but on rare occasions it may be mistaken for an acute abscess in the deeper part of the palm. Two such cases have recently presented with a soft, fluctuant, acutely inflamed subcutaneous swelling. If this is untreated, it ruptures to reveal (or if incised develops into) soft, exuberant granulations which are in danger of rapid secondary infection.



FIG. 78
Chronic painful ulcer of the finger which was shown to be tuberculous by a biopsy of the edge.

It is unwise to embark upon further exploration in the casualty department because such operations promise to develop into an extensive dissection of the flexor synovial sheaths, and to involve more skin than is apparent at the outset. A long operation completed by a skin graft leaves a patient in no fit state to be sent home, and is, in addition, apt to test the casualty surgeon beyond his skill and experience.

TUBERCULOUS DISEASE OF BONE in the adult may produce a confusing clinical picture, especially in the metacarpal bones and phalanges. X-ray changes may be late in appearance, for the focus is in the periosteum. A soft tissue chronic inflammatory swelling is the first sign, and it may actually break down or be incised before bone necrosis is established. Incision into such a slowly developing inflammation should be accompanied by removal of a portion of skin, subcutaneous tissue, and lining of the cavity for histological examination, as well as the collection of pus for the bacteriologist. The former, again, may provide a diagnosis when the latter fails to grow anything. Prolonged immobilisation in plaster of Paris must be combined with surgical eradication of the lesion.



Fig. 81
Same case as Figure 79 The plaster and skin graft dressing have been removed on the tenth post-operative day. The wound is dry and the graft firmly adherent. Hatching is due to pressure from the strands of tulle gras.



Fig. 82
Same case as Figure 79. Three weeks after operation.



Fig. 83
Same case as Figure 79 The end result, showing maximum flexion Extension was full.



FIG. 79
A lesion of the thumb with the superficial appearance of a staphylococcal abscess, but with a history extending backwards for at least three months This was a subcutaneous tuberculous abscess, communicating with tuberculous osteitis arising in the shaft of the phalanx.



FIG. 80
Same case as Figure 79 X-ray appearance on the same day

author in the last year were cured on ambulant treatment, but the head, neck and shoulders were immobilised entirely by a plaster cast. Both had failed to respond to penicillin but after incision, at which the diagnosis was confirmed, penicillin was repeated for ten days (600,000 U. daily) combined with aureomycin (500 mgm. six-hourly). The penicillin was then continued for a further three days. Immobilisation was maintained until all swelling had disappeared, which in one case was six weeks and in the other eight. Both these cases followed tooth extraction.

Acute Infections from Gram-Negative Organisms.—Chapter I has set out a policy in which it should be assumed that an acute suppuration is due to penicillin sensitive organisms, and that surgery combined with adequate administration of penicillin can be relied upon without subjecting every case to laboratory diagnosis, and without waiting for a laboratory report in any case. 95 per cent. of acute inflammation coming to a casualty department are due to the staphylococcus and streptococcus. 95 per cent. of these (1953) are penicillin sensitive. Some of the penicillin insensitive staphylococci are only moderately so, and they produce a situation (very satisfactory to practical people, if less so to the theorists) in which the right results can be obtained from the wrong presumptions (p. 11).

Some of the conditions which account for the fact that the first figure is not closer to 100 have already been described. Tuberculosis (p. 89), actinomycosis (p. 94), erysipeloid (p. 83), the secondary infection of long-standing staphylococcal lesions (p. 2), of paronychia (p. 49), or of trophic ulcers (p. 87), account for most of them. *B. coli* when encountered in infections about the nail, has probably got there by anal contact. In some cases these bacilli are associated with staphylococci which are sensitive to penicillin. Occasionally *B. coli* is obtained in pure growth. *B. proteus* is often an accidental contaminant after the swab has been taken, but it is a common secondary invader (p. 2). Superficial lesions (especially subcuticular) are amenable to the topical use of chloramphenicol. If gram-negative organisms become established in granulation tissue the granulations should be eradicated wherever this is possible (p. 130), for neither topical nor parenteral antibiotics can be relied upon to stamp them out. *B. proteus*, also, is an occasional primary invader.

CASE HISTORY

A man of twenty-three reported with a four weeks' history of swelling of the parotid region. The teeth were carious and oral sepsis was rampant but there had been no recent dental extraction. The swelling extended from the neck of the mandible to the angle. It was painful, red, tender, and brawny. Trismus was marked. The seventh nerve was not affected He had been treated with a course of penicillin for five days without any improvement.

Soon after first attendance a local softening appeared at the lower extremity of the swelling and a diagnosis of actinomycosis was entertained. The abscess was

All the cases where a local tuberculous lesion has been diagnosed should be referred to the appropriate clinic for surveillance and for an attempt to detect other tuberculous foci. Of the cases referred to in this section, only one (the case of osteitis of the fifth metacarpal) has so far shown any further sign of the disease. He developed a psoas abscess from Pott's disease a year later and required prolonged orthopaedic treatment.

Gout.—Gout gives rise to an acute inflammatory reaction. It affects the hand as well as the foot. It affects the needy as well as the self-indulgent. Acute inflammation in the neighbourhood of an arthritic joint is to be treated with caution (p. 61), and gout as an occasional cause of this clinical appearance should not be forgotten. The punched-out appearance described as characteristic of the X-ray picture does not always arrive as soon as the case itself, and early X-rays give the non-specific signs of a poly-arthritis. A pre-operative early X-ray therefore does not always avoid an incision.

If operation on a fluctuant inflamed area of the finger or thumb, or the great toe, results in the production of soft chalky material instead of pus, no great harm is done. The small cavity should be curetted gently, sutured, and obliterated by firm bandaging. Healing is prompt and relief is obtained. But it does not protect against recurrences, and recognition of the condition, even though belated, will indicate treatment (with Tr. Colchici, m.xx four-hourly) during the healing phase, and to give more lasting benefit.

Recognition should, of course, come before operation, not after, but unless one is wide awake to it all the time, it can be very deceptive. A previous history of similar attacks resolving without suppuration is of assistance. So is the occurrence of multiple spontaneous inflammatory lesions at the same time. The presence of tophi in the lobules of the ear should not be missed, but the cases which are likely to give rise to error are the ones suffering from their first attack, when none of these things may be present. If a confident diagnosis is made, operation is not necessary, and treatment with colchicum produces rapid relief from the acute attack. More prolonged treatment with "cinchophen" lies within the province of the family doctor.

Actinomycosis.—Diffuse inflammatory swellings about the mandible in the adult sometimes fail to react to penicillin. They run a slow course and usually a small area of the swelling softens to produce a superficial abscess without much resolution of the remainder of the inflammatory mass. Actinomycosis should be considered at this stage, without waiting for the appearances of the classically described multiple sinuses and discharge of "sulphur" granules. So many diffuse inflammatory masses resolve with rest and penicillin that actinomycosis provides a significant proportion of the remainder. As soon as softening takes place an incision should be made, and the pus subjected to examination.

If not treated energetically actinomycosis is a serious disease and therefore it is justifiable to adopt stern measures. The two cases seen by the

ninth day she was referred to the casualty department at another hospital. The hand was very swollen and the radial half acutely inflamed. Her temperature was 99·2 deg. The hand was put at complete rest, a swab taken, and penicillin continued. On the tenth day she announced herself improved, as she did also on the eleventh. On the afternoon of the eleventh day the swab report was returned—Staphylococcus aureus, with a high degree of penicillin resistance. It was sensitive to all other antibiotics. The next morning all the swelling had disappeared from the ulnar half of the hand (because it had been immobilised) but the thenar eminence was "ballooned" (that is, swollen dorsally and on the volar side). She was given two grams of streptomycin, and an hour later a tourniquet was applied



FIG. 84

A granuloma in the subcutaneous tissue, three weeks after onset. It was at first suspected of being a pyogenic granuloma, and in fact grew staphylococcus aureus and haemolytic streptococci. But the base is firm and almost cartilaginous, instead of soft, friable and haemorrhagic. Biopsy failed to establish a diagnosis, but it is probably Orf. This is a virus infection contracted from handling sheep. The patient was a sheep slaughterer. The lesion was curetted sharply, after high penicillin dosage, and healed to leave a thin scar after a fortnight.

and the original wound was extended for one inch distally. This allowed exploration of volar and dorsal subcutaneous areas, and an extensive abscess cavity, entirely superficial to the deep fascia, was eradicated with the curette. The surgical incision was resutured, and all blood evacuated. A dry dressing and firm bandage were applied, and the tourniquet was released. The dressing was left undisturbed for four days. One gram of streptomycin was given on the morning after operation. On the seventh post-operative day the stitches were removed. The incision had healed, but skin retraction at the original injury had left a narrow V-shaped ulcer. This healed before her next attendance, and she was therefore discharged, on her eleventh post-operative day. (Fig. 73 shows this case, being exercised on the fourth post-operative day.)

Streptomycin, however, appears to be an antibiotic against which the staphylococcus can develop rapid resistance, and its use is not recommended for other than exceptional situations. The staphylococcus is slow to develop

incised under routine penicillin preparation. There were no "sulphur" granules. The pus, apparently staphylococcal from its colour and consistency, provided a pure growth of *B. proteus*.

Immediate improvement followed incision, with return of jaw movements to full range and the disappearance of all pain. A discharging granulation persisted for a further fortnight, at which time he was dismissed with a slight asymmetry of the face from some unresolved swelling; but otherwise perfectly healed.

Diagnosis in this type of case depends upon bacteriological examination. The administration of a course of parenteral chloramphenicol is useful if the infection persists, provided always that it is combined with surgical measures to eradicate the abscess cavity if one is formed.

The Penicillin Resistant Staphylococcus.—Much the same situation obtains in infections which are due to penicillin resistant staphylococcus. It has already been pointed out that, when penicillin injections fail to clear up an infection it does not necessarily mean the *organism* is resistant. In the majority of cases other factors are responsible, and they can easily be overcome. In the remaining few it should be established by the laboratory that bacterial resistance is really at fault, and in these the use of some other antibiotic may be considered.

It should be remembered, further, that penicillin resistance is not an antibody reaction on the part of the host. It is a characteristic of the infecting organism itself. Any patient may have a series of staphylococcal infections in which sensitivity and resistance are detected in an altogether haphazard incidence. A single infection (p. 86) may give changing results to sensitivity tests. The description "penicillin sensitivity" as a characteristic of the host-patient, is a quite unrelated phenomenon (p. 77).

A case history may lead one to suspect that penicillin resistance must be considered. Medical, nursing, and other hospital staff are more likely to become infected with penicillin resistant organisms. Clean wounds which break down within a few days of hospital treatment or operation may have acquired their infection from the nurse or the instruments. Penicillin resistant staphylococcus may be suspected in breast abscesses, where the patient was delivered in hospital (p. 25).

Where operation is urgently indicated, and where a very short course of antibiotic is expected to be sufficient, streptomycin provides the steep rise in blood level which gives the best conditions for abscess eradication and rapid healing.

Case History

A woman, chopping sticks, sustained an angulated wound over the left thenar eminence. She promptly attended the nearest hospital where the wound was steeped in saline and sutured by the nurse. She was told to "go back in five days," and in spite of severe and increasing pain on the third and fourth day, obeyed her instructions literally. On the fifth day the wound was seen to be septic. Her stitches were removed, and she was then given penicillin for three days. On the

CHAPTER VI

THE CLOSED SOFT-TISSUE INJURY

MANY cases attend a casualty department with minor dislocations, sprains and contusions, which can be adequately treated there without reference to the fracture clinic or accident service. The part which the casualty department plays in the selection of cases needing specialised orthopaedic treatment will be examined in more detail in a later chapter (p. 237). This chapter will discuss certain common traumatic conditions which are not associated with bony injury, but which may have to be distinguished from them, and in which the outlook for recovery is generallv good whether special treatment is prescribed or not. It may be argued, indeed, that repeated attendances at a casualty department for this type of case are a waste of effort if the patient is going to get better anyway. Before putting such a view into practice, however, the casualty officer should determine two points in each case:

1. That treatment is unlikely to *shorten* the disability as well as unlikely to alter the end result. (The majority of sprained ankles, for instance, will recover completely in time without any treatment whatever. But many will recover much more quickly if a combination of rest and physiotherapy is used in the early stages (p. 108).)

2. That there is no danger of a complication developing if the case goes unsupervised. (The majority of contusions of the shoulder, for instance, will recover completely without any treatment. But some, if neglected, will develop very crippling fixity, and it is possible to avoid it if early treatment is instituted (p. 100).)

One cannot undertake to treat every ache and pain, every bump and bruise with prolonged physiotherapy and supervised exercises, but one can rapidly acquire enough acumen to pick out those that threaten to develop into intractable disabilities, and to arrange for special treatment; one can select those in which treatment is likely to hasten recovery,—and one can dismiss the rest more confidently if they are warned to report back if there is any failure to progress or any sign of a relapse.

Most of these acute soft tissue injuries must have an X-ray examination. Many, indeed, do not call for anything else. The casualty officer must *not* rely on his clinical judgment alone, in doubtful cases. It is not a clinical problem It is a medico-legal one. There appears to be no alternative to this steadily increasing burden on the hospital service, and it is not incumbent on the casualty officer to take responsibility for a possible error when no superior authority is able to share it.

resistance against chloramphenicol, and the latter has been recommended where more prolonged effect is desired. The use of chloramphenicol is described in the post-operative treatment of certain breast abscesses (p. 22). The rise in blood level with oral administration is relatively slow, and chloramphenicol as a pre-operative preparation is only suitable when operation can be postponed for a day.

This chapter must conclude as it began, by remarking that any and every variety of clinical and human oddity may present for attention at a casualty department. Anthrax, lymphogranuloma inguinale, rare fungoid infection, virus diseases (Fig. 84), tropical inflammations, and syphilitic ulcers may all produce conditions which test the surgeon's wit as much as his experience. The ones described above have been selected either because it is considered that standard descriptions of their features or treatment require some modification, or because they have been encountered on a number of occasions—or for both reasons. Perhaps one may be allowed to refer to them as the " common rarities." Their early recognition, and a skilful change of tactics, will avoid that small coterie of " chronics " which inhabits most departments, and whose repeated attendances are a danger to the rest, a disappointment to themselves, and a depressant, if not actually a discredit to the hospital

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is more important than the magnitude of the original lesion itself, and some cases show associated neurotic or other functional disorder. From the casualty officer's point of view, therefore, the important point is to detect unwillingness to carry out active movements at the beginning of the trouble. If such cases are referred for properly controlled active exercises and judicious physiotherapy the shoulder can be " loosened up " at an early stage and the vicious circle can be broken. An established case may need many months of treatment.

The " shoulder-hand " syndrome should be remembered when assessing the results of injury to the shoulder, and its relationship to " frozen shoulder " still requires definition. Many conditions may give rise to a limitation of movement, associated with pain, periarthritis, and osteoporosis at the shoulder, and a painful swelling of the hand. The elbow and wrist are not involved. Attempts at passive movement in the shoulder or fingers induce pain. The shoulder symptoms may resolve and a degree of movement may return in the course of a few months, though osteoporosis at the shoulder prevents full recovery. It tends to settle into a chronic affection more particularly involving the hand. Flexor contractures, muscle atrophy, and trophic changes in the skin afflict the fingers and may become permanent in untreated cases.

There is little difference between the appearance of the shoulder affection in the " shoulder-hand syndrome " and the " frozen shoulder," and it is probable that both fall into a vaguely defined group of neurotrophic disorders in which vasospasm plays an important part. Many aetiological factors may contribute to its development, and although it is a natural reaction to blame some recent injury, certain cases of myocardial infarction and cerebral thrombosis are followed by comparable complications. It is possible that many of the skeletal disabilities of the upper arm accepted as part of the legacy of a hemiplegia fall into the same category.

Actual injury, therefore, is only one source of these " vicious circle " dystrophies, and as society is more prepared to recompense a patient for sustaining a blow than for having a heart attack, it is probable that injury will continue to attract more blame for painful lesions of the shoulder than it deserves.

Some respond to surgical intervention on the sympathetic system, and the establishment of a diagnosis by the casualty officer may, in selected cases, suggest reference to a neuro-surgical department.

Sprained Wrist.—A patient who complains of a " sprained wrist " may have a fractured scaphoid, a Colles' fracture (especially an impacted one), an injury to the distal radial epiphysis (if a young person), a dislocation of the lunate, a ganglion, an acute arthritis, a chronic arthritis, an acute tenosynovitis, a stenosing tenosynovitis, or even a sprained wrist. Obvious fractures will be dealt with appropriately. Other cases with a definite history of accident

Injury to the Shoulder.—A man with a recent injury to the shoulder whose X-ray film demonstrates a bony lesion has a good prospect of receiving definitive treatment and of a rapid return to full function. Until the last decade a man with a recent injury to the shoulder with no X-ray evidence of bony injury was in some danger of suffering pain and stiffness for the rest of his life. This possibility, though much reduced, still exists. Some classification of the various conditions which may result from violence can be attempted, and in many cases a precise diagnosis and proper disposal can be decided in the casualty department. Any severe or persistent injury, whether showing X-ray signs or not, should be referred to an orthopaedic surgeon.

Complete rupture of the supraspinatus tendon produces weakness of abduction during the early part of the range of movement. When the active limit is reached, further abduction can be obtained passively without pain It can often be *maintained* by the patient himself when the support is withdrawn. These cases are to be considered for early operative treatment, as results are better then than when operation is carried out after delay.

A high proportion of persistent soft tissue lesions are due to the "painful arc" syndrome, in which abduction is painless at the beginning, painful about the second quarter, and painless again for the greater part of the last two quarters. The pain is maximal at the time the head of the humerus is completing its abduction, and abates when the humerus and scapula, held together, abduct on the thoracic wall. The commonest cause of the "painful arc" syndrome is a *partial* rupture of the supraspinatus tendon, and this may be associated with, or lead to, the other causes—a "flake" fracture of the greater tuberosity, a subacromial bursitis, degeneration in the supraspinatus tendon, or a calcified deposit in it. Milder degrees of the "painful arc" syndrome are amenable to physiotherapy and exercises after a period of rest. Unless they are quite symptom-free, they should not be dismissed without obtaining a specialist opinion.

A less common, though by no means rare affection is the "frozen shoulder." In this condition there is a diminution in the extent of *all* movements at the joint. There is much periarthritis with, at first, no X-ray evidence of a joint lesion. Pain on attempting all movements leads to progressive limitation and a steady advance of the condition. In the established case rarefaction of the bones in the neighbourhood of the joint may be due to disuse atrophy, and there may be other signs of neurotrophic disorder which have tempted observers to put the condition in line with Sudeck's osteoporosis and other related lesions (Chapter XIII).

Cases developing a "frozen shoulder" almost invariably volunteer a history of injury, though it is difficult to assess its true importance in producing the condition. It is often a trivial one, such as many people sustain without any significant disability. It is probable that the patient's *reaction* to the injury, when apprehension produces a subconscious guarding of the joint,

Some authorities pay attention to a forcible "pinching" movement, between the thumb and the rest of the hand, but this is less constant.

Although it has been accepted that it is a lesion of the tendons of the thumb, and although it has been related to stenosing tenosynovitis (below), this view has recently been questioned by Ellis (p. 109), who considers that it is an inflammatory lesion of the radial extensors of the wrist. They are forcibly rubbed against the under surface of abductor pollicis longus and extensor pollicis brevis (which lie across them in the lower third of the forearm) when the wrist is energetically dorsiflexed. Once they are inflamed, passive movement of the thumb will provoke pain in them. Ellis recommends that no treatment more vigorous than counter irritation is necessary.

Whichever anatomical explanation is the correct one (and probably both conditions occur), it may have to be accepted that by the time a case attends for treatment a cumulative condition is well established, and this can only be arrested by absolute fixation of the wrist and cessation from work. A plaster of Paris case, fixing the thumb as well as the wrist, should be worn for three weeks, or until the swelling subsides (whichever is *longer*) and on resolution the patient is warned that there is some danger of recurrence which can be checked by bandaging the wrist (to limit dorsiflexion) and continuing work. He is also instructed in a simple explanation of the mechanism of the condition, and advised to avoid the excessive movement which produces it, if he can. In intractable cases the plaster fixation may have to be maintained for five or six weeks.

Ellis remarks upon the usefulness of the leather wrist-strap worn by many labourers, and upon the fact that, although they believe it adds "strength" to their wrists, its value may lie in its distal firm edge, which catches against the dorsum of the hand and prevents full dorsiflexion. A firm bandage may have the same effect.

The main significance of a revised conception of the anatomy of the condition may lie in a divorce of this condition from *stenosing* tenosynovitis, to be discussed in the next section. There is occasionally confusion between the two conditions, possibly because they have been attributed to the same tendons. There is no indication for operation in acute tenosynovitis, and no conclusive evidence, as yet, that attacks of this condition inevitably, or even usually, produce the stenosing lesion about to be discussed.

Stenosing Tenosynovitis, Stenosing Tenovaginitis, or De Quervain's Disease.—This is a condition occasionally seen in casualty departments, and if seen, usually treated there, for the operation is comparatively simple, and usually attended with good results. Pain at the wrist on movement of the thumb is the principle complaint, but if it is associated with any particular manual movement, the association is more long standing, and more slowly developing than that of an acute tenosynovitis. There may be thickening and some tenderness of the thumb extensors proximal to the wrist, but the main

will require accurate radiography. Much information can be derived from it, and much blame attracted by omitting it.

Fractures of the scaphoid bone still escape detection from time to time, though the teaching of orthopaedic surgeons has made it well known that antero-posterior, lateral, *and oblique* views must be taken, not only immediately after the accident, but again in ten to fourteen days if the first films fail to demonstrate a lesion. These examinations must never be omitted before the case is dismissed, for failure to diagnose and treat the case properly leaves a legacy of osteoarthritis and progressive fixity in later years.

Where the case shows the clinical signs of a recently fractured scaphoid—swelling immediately distal to the radial styloid, tenderness in the same place or to the ulnar side of the extensor pollicis longus tendon, and pain in the wrist on movement—and where the first X-ray fails to demonstrate a fracture, the wrist must be immobilised in a plaster of Paris cast between the two X-ray examinations Omission to fix the wrist in the first fortnight may pro*long the total length of treatment very materially. The cast* includes the proximal segment of the thumb, and is, in fact, designed to initiate treatment for the fracture even before it is definitely diagnosed. At the end of the first fortnight, the cast is removed and the wrist supported without movement while the second X-ray examination is carried out. Further treatment is defined according to the second X-ray result.

If the injury, signs and symptoms are less typical and less severe, an elastic adhesive bandage may be used between the first and second attendances. This also must be removed for the repeated radiography.

If the condition is, in fact, a sprained wrist, ten to fourteen days in an elastic adhesive bandage will probably cure it, but similar apparent " cures " occur when *the lesion is a fracture, and are not an indication to omit the second series of films*

Acute Tenosynovitis.—Careful examination and questioning of a case complaining of a " sprained wrist " may reveal that the complaint is, more accurately, one of pain in the lower third of the forearm, and that it is located by the patient to the wrist because wrist movements, or more especially movements of the thumb, cause pain The condition is described in textbooks as an inflammatory lesion of the tendons of abductor pollicis longus and extensor pollicis brevis An elongated swelling, tender, painful, and sometimes crepitant, can be detected on the radial side of the dorsum of the forearm, and it is regarded as an effusion into the sheaths of these two tendons.

It arises most commonly when a workman has recently returned to labour after a holiday or an illness, or has recently been put on to an unaccustomed task. If the actual motion causing it is analysed, it is found that it usually includes the combination of a firmly closed fist with dorsiflexion at the wrist.

movements of the fingers and thumb must be emphasised as soon as the splint is removed. Some cases, before they are fit to be discharged, require detailed hand exercises in addition. Each joint of every finger is put through its maximum range of active movement; but it must be emphasised that other fingers and joints are allowed to move as they will while it is being done, and that all unnatural tensions must be forbidden from the beginning. The hand must be patiently re-educated and it is sometimes a tedious process. Repetition of the exercises, at home, many times a day, must be insisted on.

Many working men will refuse to undertake a course of immobilisation and rehabilitation exercises after simple dislocations of the fingers, and their attitude is not entirely without reason. A finger in plaster of Paris may prevent them following their occupation, whereas a painful swelling of a single joint may be no more than a source of discomfort and awkwardness. If X-ray examination confirms that the dislocation is fully reduced, if active movement immediately after reduction gives a reasonably extensive range of movement, if they are warned—and accept—that the disability without treatment may last for three or four months, one is hardly justified in demanding the correct alternative. The ultimate prognosis, with or without proper fixation, is almost equally good, although some cases do suffer from persistent tenderness for surprisingly long periods.

The maximum discomfort after interphalangeal sprains and dislocations is on lateral compression of the joint, and the grip may be improved by wearing a bandage *proximal* to it, not over it. When the hand is used for gripping a tool the bandage prevents the adjacent fingers from squeezing the painful one, and yet it does not obstruct the active movement of the joint itself, and takes little from the power of the grip. This may enable a labourer to work a fortnight earlier than he is prepared to do if the joint remains unprotected.

Mallet Finger.—Avulsion of the extensor tendon from the distal phalanx is a common accident whose treatment has been standardised. It is claimed that nearly all such cases can be cured by five to six weeks' immobilisation in plaster of Paris. The position maintained for this period is of extension at the distal and flexion at the proximal interphalangeal joint. Those failing to respond to six weeks' fixation can be cured by open operation, removal of any tags of tendon which have slipped inside the joint, suture into position on the dorsum of the distal phalanx, and another six weeks' fixation. Operation may be indicated, also, in cases which have been inadequately treated in the first few weeks. They are often referred when a soft, fibrous union has occurred in the flexed position. If this soft tissue is allowed to consolidate the extendor tendon is too long, and operation is designed to excise the excess fibrous tissue and reattach tendon to phalanx in full extension.

Six weeks' fixation, and possibly twelve, may be regarded as too high a price to pay for the cure of a trivial deformity, and this is one of those

location of the complaint is on the lateral surface of the radius, under the dorsal carpal ligament; close to the wrist, not on the dorsum of the forearm. Here a single click may be felt on passive movement of the thumb, but the diffuse leathery creaking often found in the acute condition is absent.

A similar condition occurs in other tendon sheaths, and is one cause of "trigger finger."

Operation consists in an incision over the thickened area in the sheath, and the sheath may be incised longitudinally, or the nodule of fibrous tissue excised entirely. Bunnell emphasises the value of probing down the fibrous sheath from above to identify the constricting ring. He also points out the insignificance of the cutaneous scar if the skin incision is a transverse one, and the edges are retracted upwards and downwards so that section of the deep fascia over the constriction can be made in the longitudinal direction. Transverse skin incisions may also be made with equal success when operating at the base of the finger for stenosing tenosynovitis of the flexor sheath.

The strictest asepsis must be adopted for these procedures. Infection of an operation field which involves a tendon sheath will produce more limitation of movement than the operation is intended to cure. Some surgeons regard these cases as candidates for admission to hospital, mainly because of this danger. They may be performed on Out-Patients in those casualty departments with justifiable confidence in their theatre precautions.

Sprained Finger.—Dislocations of the interphalangeal joints, and fractures of the phalanges without displacement, may quite conveniently be dealt with in the course of treating other soft tissue injuries, and they require no specialised after care. Bennett's fracture, metacarpal fractures, and fracture of the proximal phalanx with volar angulation are a different matter and permanent disability results from lack of proper attention They should be referred to the fracture clinic.

After reduction of dislocations, and in the treatment of "sprains" of the smaller joints (such "sprains" are often self-reduced dislocations) immobility for two or three weeks will reduce the prospect of long lasting tenderness and stiffness. It is obtained by plaster of Paris or collodion dressings, in moderate flexion, applied only to the finger concerned. The other fingers and the rest of the hand continue their function as fully as possible, and natural use is reinforced by active exercises. In septic conditions, fixation of the whole hand is recommended, in order to give the maximum opportunity for resolution and the least opportunity for the development of incoordinated movements. In any case, it is only likely to be needed for two or three days. Fixation of the whole hand for individual joint injuries is *not* recommended. Fixation of the whole hand for three weeks would raise the possibility of osteoporosis and extensive stiffness. If, therefore, the individual finger is fixed and use of the rest of the hand is allowed, the alternative risk of incoordination must be accepted. Special efforts to restore the united

that they should be treated as Out-Patients, and not allowed to take to their beds. The strapped patients should be reminded how to cough, and how to clear the sputum from the chest, before they are returned home, and it should be impressed upon them that, in spite of the pain, any coughing to which they are impelled must not be inhibited. Those proving difficult to educate in this matter may need the assistance of the physiotherapist, with supervised breathing exercises.

Sprained Ankle.—Once it has been established (usually, in these days, by radiology rather than by examination) that the injury to the ankle is a sprain, and not a fracture, there is a wide choice of treatment or disposal. The majority of clinics send the case away again with the reassurance provided by the X-ray, and the ankle is allowed to get better at its own pace. Nominal instructions for him to see his own doctor, with a note on the X-ray findings, usually mean that the patient hobbles about for a day or two, limps about his recreations for a week or two, then returns to work. Recovery of function is usually complete whatever the treatment, but a few cases, where it has not been appreciated that the injury is a complete rupture of the middle part of the lateral ligament, may subsequently suffer from a permanent instability and the insidious development of osteoarthritis. This type of injury is well illustrated and discussed in Watson-Jones' treatise on fractures (to which the reader is referred) and is the main justification for the widely-held belief, which he quotes, that it is better to break one's ankle than to sprain it.

Such severe injuries should be diagnosed as early as possible. Suspicion is aroused by the severity of the pain and reactionary swelling, or by a history of an audible crack or tearing noise at the time of the accident. The X-ray shows little or no signs of bony injury, but if the antero-posterior view is taken, with the foot in inversion (using local anaesthetic infiltration if necessary) a widening of the outer part of the joint space can be demonstrated. These cases should be selected at once, and referred to the fracture clinic, or immobilised for at least six weeks in walking plasters.

Many X-rays show a small chip off the external malleolus, with little or no displacement, and these cases can be treated as sprains just as though there was no evidence of bony damage. It is caused by an avulsion of the tip of the bone when the ligament is wrenched. Whether damage occurs just on the bony side or just on the ligamentous side of the attachment is immaterial from the clinical point of view, though it makes all the difference to the X-ray picture. Attention is paid to the severity of the soft tissue injury, whether it is accompanied by radiographic signs or not. Such a picture does not imply any lateral or medial dislocation of the joint, nor any interference with the mortice. Rupture of the whole of the middle fasciculus of the external lateral ligament, with the danger of a permanently unstable ankle, can occur with or without it.

conditions in which the cure may not be worth the treatment. Many men cannot work with one finger in plaster in such an unnatural position. Even if they could the plaster would soon be battered into ineffectiveness. A mallet finger takes nothing from the grip, for the flexor tendon is intact. It has little or no increased liability to trauma, for it does not project when the fist is clenched. Manual workers will often prefer to leave it untreated, and tolerate the temporary pain, rather than accept the prolonged treatment necessary for a cure. One cannot blame them.

The first requirement of the working man is that his hand shall have full firm flexion, and almost any length of disability is justifiable in order to obtain it. If this is not in jeopardy, it is not reasonable to expect him to undergo many weeks of treatment for a slight improvement in function which, although perhaps quite satisfactory from the anatomical point of view, is not necessary for him to carry on his work.

Women are frequent sufferers because a common cause of the accident is turning the mattress. They are also more frequently inclined to accept the conditions of treatment. Prolonged immobilisation does not entirely prevent them from going about their essential activities. A mallet finger is a greater disability in feminine occupations such as needlework, for it gets in the way, and gets pricked. The price of success is not as high as for the male, and the reward is higher. Perhaps, also, the greater willingness to accept operation is prompted by cosmetic reasons, and women are more prepared to take trouble over the appearance of their hands.

Fractured Ribs.—Injuries to the thoracic cage which are suspected of internal injury, or of developing pneumonia, who show signs of shock or who are injured on both sides, require In-Patient observation. Other cases, associated with other injuries, especially fracture of the scapula, the sternum or clavicle, require reference to the fracture clinic. Most of the remainder are suitable for ambulant treatment.

One should be guided by clinical findings rather than radiographic evidence, especially if the latter is negative. Injuries to the costal cartilages cause as much disability as of the ribs themselves, though they give no evidence on X-ray. Many cases suspected of bony injury fail to show it in the film, but they still require treatment.

Those who favour injection of the painful area with novocain need not be discouraged from doing so, but there is a steadily growing tendency to return to the old-fashioned routine of applying firm strapping to the area, the ends of the strapping extending well over to the opposite side both in front and behind. The swing-back to this method may have been accelerated now that the main objection to it—the development of hypostatic pneumonia from reduced respiratory excursion—has been robbed of much of its terror by the might of the antibiotics. Nevertheless, especially in the aged, who easily sustain fractures of the ribs from rather trivial accidents, such a complication cannot entirely be forgotten. It is often to their own advantage

careful supervision by trained physiotherapists in the first seven to ten days. In the majority of the slight injuries, however, it is doubtful if the amount of improvement justifies the extra burden on the hospital. In those of moderate degree, a clear understanding of the precise site of the damage, and a judiciously timed change-over from immobility to exercise will give considerably improved results. In this grade reference to the physiotherapy department repays the extra trouble. The third group of cases should be referred to the orthopaedic department. Clinical severity, whether accompanied by radiological signs of bony injury, or not, is an indication for specialised treatment.

Injury to the Knee.—Attention should be given to at least four points.

1. Any injury to the knee may develop a vicious circle condition if it is not realised that an effusion will produce quadriceps wasting, and quadriceps wasting will increase an effusion.

2. A history of locking is an indication for reference to an orthopaedic department, but reference to an orthopaedic department should not be confined to cases with a history of locking.

3. Pain in the knee is sometimes the first sign of hip disease, and may be erroneously attributed to a recent accident to the knee which has nothing to do with it.

4. Minor trauma in the young, followed by local pain and tenderness, may be due to osteomyelitis, and this presents most frequently near the knee; next most frequently at the ankle.

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If cases of sprained ankle are treated in the casualty department it becomes apparent that the diagnosis is of a group of injuries rather than a single one, ranging in severity from a rupture of a few fibres to the type of lesion referred to above; and further, that there is considerable variety in the site of injury. Not all sprains of the ankle are uncomplicated injuries to the external lateral ligament, and tenderness can sometimes be found mainly localised to the posterior aspect of the external malleolus, the lateral extremity of the cruciate ligament, the peroneal retinaculum, or even on the medial side over the internal lateral ligament or the insertion of tibialis anterior. Tenderness may be maximal over the external malleolus itself even though no fracture is present. In a few cases the damage is confined to the posterior fasciculus (the posterior talo-fibular ligament) and these show little swelling, and no precise point of tenderness at all. The lesion is protected from direct pressure by the tendo Achillis, and the fibro-fatty tissue between the ligament and the tendon accommodates much of the reactionary swelling.

These distinctions are not merely of academic interest, for if active treatment by the physiotherapist is requested it is useless to encourage her to devote her attention to the external lateral ligament if the damage is somewhere else, and if the routine treatment favoured is strapping *in eversion* it will be found that some cases cannot tolerate it. Forced eversion of the injured joint may result in compression of the haematoma, and the pain produced from this may destroy any advantage provided by relaxation of the external lateral ligament—particularly if the external lateral ligament is only part of the injury, or not injured at all. When this occurs, the strapping is removed at home by the patient because he cannot walk. In the majority of cases fixation of the ankle in the neutral position is most likely to give maximum comfort, and is just as effective.

Treatment of sprained ankles in the casualty department commonly takes one of three lines.

1. The ankle is strapped, the patient instructed on a few simple exercises, and he is seen at weekly intervals until he is fit for work again. This course cannot be expected to shorten his incapacity by very much, though the support allows him to make a little use of it.

2. Arrangements are made for daily treatment with massage, supervised exercises, and physical treatment such as aerated baths, and short wave diathermy; followed by more energetic gymnastics, massage and faradism; so that the ankle finishes its treatment not only restored, but better than it has ever been before, and better than the other one.

3. The leg is put in a walking plaster, and maintained in it until all pain has disappeared, as is necessary for complete rupture of the ligament.

Clinical division of sprained ankles should be into three grades—slight, moderate and severe. Slight need little, moderate need active, and severe need drastic treatment. It is probable that all cases in the first two grades profit from an accurate assessment of the nature of the injury, and from

It is quite unnecessary to require an inspection of every lacerated wound every day or two to see if it is healing satisfactorily. If there is to be sepsis it is unlikely that it will appear within the first two or three days. If and when it does the patient will know himself, because of *increase* in pain in the wound, or the appearance of pain elsewhere (such as in the elbow, the axilla, or the groin) for the first time. These possibilities should be explained to him, and thereby many unnecessary attendances are avoided.

One or two days taken from the healing time of each case, aggregates to a saving of many weeks when a department is treating from two to three thousand cases a year. These cases can be seen two or three times instead of four or five. They can be healed in five days instead of eight or nine. An extra stitch may make all the difference.

Chemotherapy or the administration of antibiotics is no substitute for attention to any of the three cardinal points. If the wound is not cleaned, they will not clean it. If a little fat thrusts through the line, it will granulate and they cannot stop it. If the skin becomes macerated the wound will gape, and is in danger of breaking down however " penicillinised " it remains. More wounds break down by omitting to tell a patient to keep his bandage dry than by omitting to give him penicillin, and a stitch in time saves nine days.

One can, indeed, go further than this, and say that in this type of wound, chemotherapy or antibiotics will hardly reduce the sepsis rate at all, because the initial infection can be cleaned away from it, and it is the repeated re-infections when the wound is inadequately closed which cause trouble. It is not necessary to give injections " just in case." An injection without proper indication for it is an insult. If every casualty department in every year unnecessarily injects two thousand patients for three or four days the insult becomes a national one.

A small percentage—not more than five—will report back with inflammation, or will show inflammation on the fifth day, or will develop (this rather earlier, on the second or third) a " streak " or an inflamed gland. These cases are at once put on a maintenance dose of penicillin, 300,000 U. procaine penicillin suspension daily, and the wound, if possible (as in a hand) put at absolute rest. in a splint and sling. They are then seen and inspected daily. Most of them settle down. A very few will proceed to breakdown and require second intention treatment.

This routine requires:—

1. That the case shall have been seen early.
2. That it is not complicated by bone, joint, or tendon involvement.
3. That it can be sutured precisely without tension—that is, that the injury has not resulted in skin loss.

The last two points will be referred to later (pp. 122, 126 and 131). Delay in attention to the wound makes up the majority of the remaining cases, and requires consideration here.

CHAPTER VII

SOFT-TISSUE INJURIES WITH BREACH OF SURFACE

LACERATED WOUNDS.— Incised, lacerated, or penetrating wounds, of such magnitude that they profit by suture, constitute up to 20 per cent. of the cases attending the department. If a standardised approach is adopted, the maximum number can be healed in the minimum time, with a minimum amount of effort. Some departments develop the "business efficiency" approach to a fine art, and their dressing clinics are run on an "assembly line" system which deals with very large numbers in a very short time. The reader is referred to Ellis (p. *129*) whose methods are particularly applicable to the larger attendances of teaching hospitals, and whose reserve of student dressers makes the system possible; or to page 194, where a less elaborate system can be run with one medical officer and two or three nurses. Different conditions call for different methods. Keeping the queue moving all the time is an essential part of all of them. So is an insistence on rapidity of turnover.

Ninety per cent. of lacerated wounds are superficial and uncomplicated, and attend within an hour or two of injury. They require attention to three points, *and no more*, to obtain rapid healing:—

1. Careful physical cleansing.
2. Meticulous suture.
3. Dry dressings kept dry.

Such a wound is carefully cleaned (often by the patient himself) with small pledgets soaked in a solution of "cetavlon." It is dried by the nurse with dry sterile gauze. It is *exactly* sutured with fine sharp needles and fine "nylon" thread (p. 196). Enough stitches are inserted to ensure apposition of true skin along its whole length. No prolapse of subcutaneous tissue, and no inclusion of tags of cuticle in the wound, are tolerated. It is covered with a dry sterile gauze dressing and an open wove bandage. The patient is clearly instructed that no part of the bandage must be allowed to get wet, that if he has any increasing discomfort he is to report back at any time, and that if he remains comfortable he is to report back on the fifth day.

On the fifth day the wound is inspected. It is healed. The stitches are removed and a dry sterile dressing applied. The patient is told to keep the bandage dry for two more days. If there is any trouble he is to report back. If not he is to regard himself as discharged. Within a week of the accident he is fit for work.

If the wound is not quite firm the stitches are retained for two more days, and he is told to make an extra—his third—attendance.

In cases of two or three days' standing, delayed suture may be considered —and thenceforth at any stage, if it can be carried out without tension, if there is no reactionary swelling, and if there is reason to believe that infection is under control.

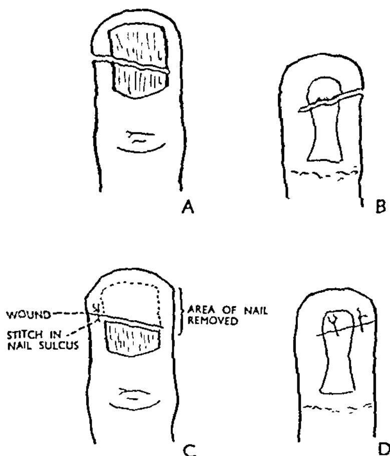


FIG. 85

A common injury in small children by jamming the finger ends in a door (A and B). Enough nail is removed for the wound in the nail bed to be adequately exposed. It is very seldom necessary to remove the whole nail. The nail bed is reconstituted by a single stitch in the nail sulcus (C). The wound on the volar surface is sutured precisely (D) The distal fragment of phalanx usually retains enough attachment to soft tissue for survival. It is therefore usually not necessary to "fillet" the flap.

CASE HISTORIES

CASE 1. A child of three crushed a finger tip in the door on a windy day. The tip was almost severed, and the flap carried the distal third of the nail and nail bed, the tip of the phalanx, and most of the volar surface of the pulp. It was attached only by one side of the pulp tissue. (This is a very common injury in small children and the two following cases had exactly comparable damage (Fig 85).)

Bohler laid down a maximum of eight hours for attempts at primary suture of wounds, but it is obvious that no precise criterion can be adopted, for a wound with much contusion and impairment of blood supply will break down more easily than an incised wound, even if it is seen much sooner. A wound which can be entirely excised and sutured without tension may be healed when a more recent one, because it cannot be excised, will be in danger of breaking down. Wounds of the hand and foot can seldom be excised completely because the skin is unyielding and tension at the suture line would inevitably result. Wounds in the young have a better prognosis than similar wounds in the aged. The scalp, the face and the scrotum have the best blood supply of the whole body surface and heal well. Flaps of skin whose base is directed proximally may heal when flaps of the same size whose base is at the other end will slough. Each case must be judged on its own merits.

It is advisable to lay down that any wound of more than four or five hours' duration should have prophylactic injections of penicillin for the first two or three days. It has been impossible to prove that these injections have a statistical significance, and examples are frequent where they have been omitted without ill effect. Nevertheless, many clinical observations have justified their administration.

The adoption of antibiotic therapy must not be allowed to excuse inattention to proper surgical principles, and in particular to proper fixation of the wound from the beginning of treatment. Oedema and inflammatory reaction are established when the late wound attends. If they are assisted to resolve by firm dressing and proper splintage it may be possible to carry out a delayed primary suture on the fourth or fifth day, or a secondary suture with eradication of granulations at a somewhat later stage. No opportunity to achieve skin cover, at whatever stage, should be missed. Fine judgment may be required in these cases; cover by antibiotics, and bacteriological control, may be of value in coming to a judgment, but they do not replace it.

Excision of the edges of the wound is seldom necessary in the casualty department, but much contusion of the edges, especially when associated with a number of hours' delay in attention, may indicate it. In many situations the increased loss of skin surface which it entails is of little moment, and accurate suture without tension is still possible. In other situations (including the hand and foot, as has been mentioned) it may commit the surgeon to skin grafting (p. 131) and should not be undertaken lightly. In the scalp and equally vascular situations it may be unnecessary, when a similar wound elsewhere might need it. In most cases, however, where excision appears both necessary and feasible, it is better to do so than to accept the alternative of a longer wait for delayed suture.

Excision of wounds of the face should not be undertaken. If the conditions are such that they suggest it they are such that a plastic surgery unit should undertake treatment at the first opportunity.

either for secondary suture or for secondary skin grafting. Retraction takes place most in wounds of the palmar surface of the hand, and the edges cannot be brought together without formal wound excision. Formal wound excision necessitates the loss of skin which the palm can ill afford, and attempts to close the wound by these methods often result in a suture line under tension which promptly breaks down again. Therefore, in these cases, and in others where similar conditions are found, secondary skin grafting is better.

Granulations are a focus of infection and they should be removed as a preliminary either to secondary suture or to skin grafting.

Involvement of deep fascia (especially the palmar fascia) is a complication which often receives inadequate attention. If the deep fascia is not involved, subsequent scar contracture is improbable. If it is, and especially if the central part of the palmar fascia, or the volar midline of a finger is concerned, contracture may develop and give rise to later disability. Wounds and incisions crossing a natural palmar crease at right angles, if they involve the deep fascia, are particularly prone to it. It progresses to some extent after healing takes place, in much the same fashion as Dupuytren's contracture progresses. Never, perhaps, to that extreme degree sometimes seen in Dupuytren's contracture, where the flexed finger is slowly driven into the palm to produce pressure necrosis in it. Many contractures of the finger are due to this involvement of palmar fascia after injury. It is often misdiagnosed as shortening of the flexor tendons. The flexor tendon contracture is secondary to the condition, not causative.

Palmar wounds which show much damage to the underlying fibrous tissue require an excision of all damaged fibres as well as careful cutaneous suture. Skin loss, again, must be made good at once by grafting, not by suture under tension.

In many cases the excessive fibrous tissue absorbs in the course of the next two or three months, but it is often impossible to foretell this with confidence and prognosis should be guarded. Resolution may be assisted by active exercises and physiotherapy. Superficial X-rays, the injection of fibrolysin and administration of vitamin E all have their advocates, but the effect of any of them is not definitely established. Excision of the contracting band, or formal excision of the whole of the palmar fascia, with skin grafting where skin loss results from the operation, may be indicated in severe cases.

Lacerated wounds, contusions, and abrasions of the lower half of the leg require special mention. The blood supply to this part of the body surface is at all times more precarious than elsewhere. In the middle-aged and elderly, with varicose veins, gravitational oedema, eczema, and other similar disabilities a minor wound is liable to heal slowly, or even to develop into a "varicose" ulcer with chronic discharge and indolent extension (Fig. 86).

Many gravitational ulcers date their disability from a minor injury to the front of the leg. Subjects who are suspected of this disposition should have the usual proper care of the wound, and the dressing should be incorporated

The patient was given penicillin injections and a flavine dressing for the first five days. Excessive granulations developed. There was some sloughing of the soft tissue of the pulp. The wound granulated for some weeks and finally healed with a moderate loss of pulp tissue and permanent deformity of the finger and nail bed. Total incapacity, 4½ weeks Attendances, 15.

CASE 2 A similar case similarly treated for five days. On the sixth day it was referred to the casualty department. Under high dosage of penicillin both fragments of the nail were removed—the proximal half of the nail bed was infected—the granulations were very gently scraped down to their fibrous base and the distal fragment of the infected phalanx was excised The filletted flap was exactly sutured back to the base. Penicillin was given on the first post-operative day. The wound was redressed on the fourth day with dry gauze. On the seventh, residual infection of the nail bed was treated with topical chloramphenicol and the stitches were removed The chloramphenicol was repeated on the tenth. On the twelfth the patient was discharged with a dry dressing. There was then some deformity of the nail bed and the finger but less than in Case 1.

Total incapacity, 17 days Attendances, 10

CASE 3. A similar case seen and operated on within three hours of injury. No antibiotics were given Operation was carried out under general anaesthesia using a sphygmomanometer tourniquet. The distal fragment of nail was excised, and the proximal fragment trimmed back until it was clear of the wound (Fig. 85, C). The phalangeal fragment was well attached to soft tissue and was preserved. A stitch was inserted at the nail sulcus to reconstitute the nail bed precisely. The edges of the wound on the volar surface were brought together without prolapse of fatty tissue by two more sutures (Fig. 85, D) A dry dressing was applied and the tourniquet released.

The wound was redressed on the fifth day. It was healed. The stitches were removed. A dry dressing was applied and the child dismissed with instructions to keep the bandage dry for two more days

Incapacity, 5 days. Attendances, 2

It is not necessary—or, indeed, possible—to fix the distal fragment of these phalangeal fractures by splints.

(See also pp. 116 and 132)

In 1948 the sepsis rate for lacerated wounds in this clinic was almost 20 per cent., 15 per cent. of all cases had penicillin at some stage in their treatment, and the average length of incapacity for all cases was twenty-one days. In 1952 the sepsis rate was 8½ per cent., although only 11 per cent. were treated with penicillin. The average incapacity was eight days

If skin cover is not obtained, if skin flaps slough, or if wound breakdown occurs, a granulating surface is established, and the preceding chapters have detailed the disadvantages of this situation In the majority it is obvious that the breakdown is superficial and that a few days' treatment with dry dressings or a harmless local application will allow epithelialisation and healing. Some, where skin retraction opens up the wound, produce a lesion which has every appearance of persisting for a number of weeks (p. 11). These are candidates

anaesthesia. A tourniquet is helpful at least in the early stages of the operation, in order to make a rapid and precise estimate of the damage. If there is a suspicion of fracture into the joint, a pre-operative X-ray is sometimes helpful, but it is usually unnecessary to delay treatment while X-ray plates are developed because if the phalanx is broken it will be observed at operation, and because the bony lesion is usually of subsidiary importance anyway. The nail bed, and the pulp space injury, are the important ones.

Careless traction on the nail which may be " hanging on by a thread " may do irreparable damage, for the nail bed itself is often carried away from the phalanx, and is attached to the undersurface of the loose nail. This nail bed must be detached from the nail and reconstituted, and every fragment which still has soft tissue attachment must be preserved. Any fragments of phalanx with good soft tissue attachments are equally valuable. If the damage to the nail is entirely distal to the nail fold (as in the cases described at p. 113) the base of the nail should be retained, and the distal end of the basal fragment trimmed back. Infection tends to persist in the nail fold if the whole nail is avulsed, and at the wound itself if the nail overhangs it. In those cases where the nail (with or without part of the nail bed) has been entirely torn from its base, preservation of any of the nail itself is unwise. The volar lacerations are sutured, and any retaining sutures at the nail sulcus which may be applied are used to fix back as much of the nail bed as possible. The nail bed itself will not hold sutures. Any skin loss is made good by a split skin graft (p. 135), and the wound held in place on to the shaft of the phalanx by a single layer of petroleum jelly gauze, well rubbed out. The whole is covered by dry gauze dressing, or a pressure dressing if a graft has been applied (p. 136), with open wove bandage over all. Post-operative bleeding will provide adequate splintage.

Provided that there is no symptom of sepsis, the first dressing should be delayed for at least a week, and the operation dressing must be very carefully detached from the wound, so that the reconstituting nail bed, and the graft, if one has been used, may not be further damaged.

It is often maintained that immediate amputation of the distal segment of the finger is the proper treatment for the more severe examples of this injury, because an amputation results in quick healing and a return to work within three weeks. Many cases treated as described above are back at work in three weeks, with an intact (though temporarily nail-less) finger, and they have a good prospect of ultimate return to full function. Occasionally deformity of the nail bed results in a permanently distorted nail, and this requires treatment at a later stage (p. 173), but many finger ends can be saved by prompt and detailed surgery.

Subungual Haematoma.—Haemorrhage under the finger nail produces an acutely painful condition which tempts the patient to demand and the surgeon to provide immediate treatment. A variety of procedures is recom-

in a " viscopaste " bandage from the toes to the knee. They should, in fact, be treated for the ulcer they might otherwise develop. Attention to the prevention of congestion about the wound is as important as attention to the wound itself. It is too much to expect such cases to be discharged on their fifth day. They must be kept under observation, and under treatment, until all danger of chronicity has been passed. This may not be for some weeks.



FIG. 86

The granulating area below and behind the internal malleolus was the result of a metal burn Three attempts at skin graft failed The area around it was widely affected by an eczematous reaction The eczema and failure of the grafting operations were both due to a gravitational oedema. Admission to hospital for absolute rest cured both conditions in two and a half weeks Attempts to treat the case as an ambulant one were responsible for early failure.

The Burst Finger End.—A very common and most painful injury results from a mishit with a hammer, or from other accidents which crush the finger end. It may be regarded as a more severe variety of the wound of the finger tip which has been used as an illustration in the previous section (p. 113). When analysed it amounts to a contusion with bursting asunder of the pulp tissue, a comminuted fracture of the phalanx, a traumatic avulsion of the nail, and a laceration of the nail bed, each occurring in an independently variable degree. These cases repay careful surgery with a sound normal finger, but if neglected lead to much delay in healing and considerable deformity. Very careful cleansing with a detergent is a proper preliminary to operation under

dressings, but they should be reviewed more frequently than once a week. The persistence of serous discharge for more than a day or two, or the development of infection, gives rise to suspicion of an underlying nail bed laceration. It calls for exploration under anaesthesia, the resection of nail as for a paronychia, and exposure of the affected part of the nail bed. Lacerations of the nail bed itself account for nearly all the cases which fail to heal promptly, provided that the surgeon does not avulse any nail which is normally attached to its bed in the course of his treatment.

Many cases are referred with a diagnosis of infection, made on the basis merely of persistent pain. Infection in the ruptured subungual haematoma is apparent because pus can be expressed. Infection in the unruptured subungual haematoma is rare. The exposed base of the nail, shining through the haematoma, looks yellow and makes the diagnosis difficult. If the case is over twenty-four hours old, and pain is not *increasing*, one can delay a decision. If it is over twenty-four hours old and the pain is getting worse, a short incision in the nail fold, in line with the sulcus, is justified; but it commits the patient to a dressing which must be kept quite dry for three or four days. This may mean stopping work.

If the varieties of nail injury are identified on these lines many unnecessary operations will be avoided, those cases requiring operation will be selected early, and infection will be reduced to a minimum.

Foreign Body under the Nail.—The majority are slivers of wood, acquired from benches, tables, floors, and skirting boards. Most are pulled out at home or work and nothing more is heard about them. If the foreign body cannot be removed at home the patient attends for removal, and prompt removal almost invariably results in complete healing without sepsis. Some can be removed in the clinic because it is furnished with more suitable instruments than the home. The rest require anaesthesia because some of the nail must be excised to get a hold. If nail excision is necessary, the best precaution against sepsis is to remove a little more nail than covers the wound in the nail bed. If a little pocket of lacerated nail bed remains covered by nail a subonychial suppuration may spread. A wedge-shaped resection, exposing the whole of the splinter, should be made. Excessive removal or complete avulsion is unnecessary. A dry dressing over it results in healing in two or three days. With recent injuries antibiotics are superfluous.

Occasionally a neglected or unnoticed foreign body under the nail is a cause of persistent paronychia, and some of these are not discovered until at an operation for septic complication.

Long splinters running under the nail fold and into the dorsal subcutaneous tissue may demand an incision to expose them and to allow inspection of the track for further small fragments. This may safely be resutured at the end of the operation provided the case returns for observation or is warned to attend if there is further pain. Very occasionally such a long

mended from time to time, each of which has the great advantage of producing dramatic relief, an impressed and often effusively grateful patient, and a complacent surgeon. All of them, at one time or another, can be blamed for an infected finger nail, a second operation for paronychia, a return of pain at a later date, and much prolonged incapacity. Some, (as, for instance, routine avulsion of the nail, which is still practised in some hospitals) undoubtedly and almost invariably lead to unnecessary prolongation of incapacity and inability to work.

By far the majority of cases which are and remain unruptured can be expected to be pain-free and capable of work within two days. Most can be returned to work at once with a protective dressing. Incision, aspiration, drilling, and other procedures which have been recommended leave a condition in which care must be taken to avoid infection of the nail bed. They produce almost immediate comfort but they do, to a certain extent, increase the ultimate hazard. Most cases, therefore, will be quite content to accept advice rather than interference, and to have no treatment other than a careful cleaning of the finger, a sterile protective gauze dressing, and two or three aspirins for the first night. Many of these cases are referred by works first-aid posts or nurses' centres, sometimes against the will of the patient, and much unnecessary loss of working time can be caused by over-treatment.

The patient is warned that he will probably lose the nail in any case, but that by the time it is shed spontaneously the tissues under it will be healed and the new nail will be well on the way.

When the nail is completely avulsed the situation must, of course, be accepted The wound is carefully cleaned and a dry sterile dressing applied until the lesion is healed. Such cases need not be redressed in the first week unless there are signs of sepsis, and an adherent dressing should not be torn off to inspect the area at frequent intervals. The edge should be gently lifted on the seventh or eighth day. If a little serum comes out, or a bleeding surface is exposed, the dressing is not disturbed further, and no more need be done for two or three days. When careful peeling away shows a dried nail bed, the case can be discharged with advice to maintain a protective dressing until the tenderness has gone. The average disability for a complete avulsion, when treated by this method, is eight days.

Some nails remain attached by their distal parts, but the base is " sprung " from the nail fold and lies over it. This separated part can be trimmed away with sharp scissors, the fold dried out and dressed, and the normally attached part retained These cases also show rapid recovery if toilet is adequate and subsequent dressings are infrequent. In children, however, this appearance sometimes indicates a compound separation of the epiphysis.

Those that have a subungual haemorrhage which has ruptured and bled require more careful observation. Some, with associated soft tissue lacerations, come more properly into the category of the " burst finger end " and are to be treated as such Others may heal well by a careful toilet and dry

of leaving it where it is are appreciated by the surgeon and the patient the postponement of the decision becomes an acceptable—and often preferable—alternative. It is much worse, from every point of view, to subject the patient to an unsuccessful exploration than to persuade him that exploration is unnecessary.

1. The most usual course is for the pain and tenderness to disappear and for the foreign body to give rise to no further symptoms. Pain and tenderness are not due to the foreign body itself but to the wound caused by its entry, and when the wound heals the disability disappears. X-rays taken for other purposes (especially of the hands of engineering tradesmen) frequently reveal a number of unsuspected metallic chips which are causing no symptoms, and which must have been acquired unnoticed on previous occasions. It is unnecessary and unwise to inform the patient of their existence, and it demonstrates that the majority of foreign bodies, provided the patient has no anxiety about them, are harmless.

It must be explained to the patient, when it is decided that exploration is unnecessary, that these bodies become walled off and cease to cause trouble within a week or two of injury, and before he is discharged he must be warned to attend again if there is any untoward development at any time. This advice covers the contingencies to be discussed in the following.

2. A small number give rise to a septic wound, because they have carried infection from the skin at the point of entry, or because of the nature of the missile. They require observation and treatment for the septic condition itself, and if suppuration supervenes exploration of the abscess cavity may succeed in evacuating the foreign body with the pus. It is justifiable to prolong the operation in order to find it. Such a course is often successful, but after failures a recurrence of infection or the persistence of a sinus is likely and a formal exploration under major surgical conditions may be necessary.

3. A foreign body which has penetrated a tendon sheath, or a joint, or is lying on a peripheral nerve, requires removal because it is likely to give rise to permanent trouble. In such cases its position can be gauged because of the symptoms it causes, and a careful history, together with X-ray localisation, enable the surgeon to make a deliberate exploration, exposing the structure concerned, rather than exploring the track of the missile.

A formal operation of this type requires an unhurried ritual, good light, and good anaesthesia. It can be undertaken at any time after the accident, though early operations are best carried out with antibiotic cover. Many of these cases do not attend until some time after the injury, and it is a persistence of their complaint or disability which leads them to seek advice. If infection is the precipitating factor, it should be controlled before operation is contemplated, though high level penicillin preparation allows early intervention in an increasing number.

4. A late complication is the development of an inclusion dermoid. The condition will be discussed at p. 160, but its occasional association with the

fragment will penetrate the base of the nail bed and run along the dorsum through the insertion of the extensor tendon into the distal interphalangeal joint. These cases should have the hand put at rest and be given antibiotic therapy for four or five days after the removal of the splinter, and they may be expected to heal without infection. It is *not* wise to prolong an incision into the joint itself. Such small penetrating wounds do not often produce suppurative arthritis, provided the splinter is removed early, but the possibility must be entertained, and it is suggested by the persistence of thin, almost colourless discharge for more than a day or two after the accident (p. 60).

Retained Foreign Body.—An exasperating hunt for a small piece of metal may destroy a whole morning's well-organised work, with no booty to display at the end of it. Judgment when to operate and when to leave alone is very slowly acquired, and, when it is acquired, opinions differ. More damage can be done by a surgical approach to a foreign body than by the foreign body remaining where it is indefinitely. In some patients the knowledge that they have an irremovable foreign body will be of more concern to them than a considerable mutilation in order to extract it. It may be proper to explore in one case, and a mistake in another.

When the case is first seen, a decision should be made on the basis of facility. If the foreign body is easily accessible, superficial (and especially if it is palpable) a prompt incision and removal, with accurate resuture, will avoid further uncertainties, and put the patient through the same routine as for a recent incised wound. He is cleared of all his problems in a week. A long incision heals just as quickly as a short one, if it is sutured exactly. It will cause no more disability, if it is sited and directed intelligently. It will have the inestimable advantage of allowing the surgeon to explore the wound with his finger, instead of a probe. The finger is the only simple instrument intelligent enough to distinguish a foreign body from bands of fibrous tissue feeling and sounding, with an instrument, just like it. Operation with a tourniquet, where it is applicable, enables him to follow the discoloration and damage in the track of the missile, and to identify any important structures on the way. Provided that any visible vessels he has had to cut are ligatured, it will be of advantage to resuture the wound and apply a firm bandage before the tourniquet is released. A check must be made that the distal circulation is restored, before the patient is allowed to go home.

An operation of this nature carried out within a few hours of injury may be expected to give first intention healing without antibiotic therapy.

Only too often what promises to be a simple and gratifying procedure such as this turns into a protracted and unsuccessful exploration, and it is better to await events if there is any doubt about the position. X-ray examination may be able to pin-point it exactly, but this is less often the case than might be expected. Operating under the screen is frequently an unsatisfactory, time-consuming, and surgically undesirable performance. If the pros and cons

sheath produces an increased secretion which oozes through the wound and delays healing. It does not necessarily indicate sepsis but it requires more prolonged immobilisation and an increased number of attendances. Most orthopaedic surgeons prefer to postpone secondary operations on tendons until the fourth to sixth week.

Many cases, having extensive laceration or destruction of the tendon, are unsuitable for primary suture however early they are seen. Others are unsuitable because of associated injuries to other structures. In such contingencies it may be of more importance to secure early skin cover and first intention healing at the surface than to make a decision on the treatment of the tendon itself.

Damage to both flexor tendons associated with a compound injury to a bone or joint (especially if accompanied by skin loss) is usually accepted as justification for immediate amputation in any digit except the thumb. Even this view, however, may be modified on occasions, and especially if other fingers have already been lost. To amputate the middle finger when the index has gone is worse than to amputate the index when the rest of the hand is intact. Educating the ring finger when there are only two left is a much more difficult task than educating the middle after loss of the index.

Damage to the superficial aspect of the tendon sheath in lacerated wounds of the fingers is commoner than laceration of the tendons. It is not an indication for drastic decisions, for a good—often full—range of movement can be obtained within a few weeks of injury (p. 132). These cases can be put on to active hand exercises as soon as they are healed (a tendon suture case must be immobilised for at least three weeks) but it must be noted again that skin healing is often slow because of the synovial "leak" through the wound, and immobilisation to obtain surface healing may have to be prolonged as long as three weeks. These cases have the great advantage over those with tendon section that adhesion of the scar in the sheath to the surface of the intact tendon is improbable. Where tendon and sheath are both damaged adhesions are pronounced. In addition, in the former most vigorous muscle contractions, once the skin is healed, can do nothing but good. One views over-active exercises after tendon suture with some apprehension lest they stretch the junction or break it away.

Isolated Section of Flexor Digitorum Profundus.—*If the flexor profundus tendon is severed distal to the base of the middle phalanx, the sublimis insertion is unaffected. The proximal end of the cut tendon slips up into the hand, and does nothing to interfere with sublimis function. By the time the wound is healed the fist can be clenched again with the affected digit flexing at the proximal two joints. It cannot flex at the distal joint, but the finger can touch the palm and the middle segments of all the fingers can lie in line together (cf. Fig. 60). The hand as a whole remains a useful member.*

presence of a penetrating foreign body must be referred to here. It arises when surviving epithelial cells are carried in with the foreign body, to form a cell rest on its surface, and, after a delay of some months, to develop into a slowly expanding cystic swelling. Operation on such tumours sometimes leads to the removal of a foreign body which by that time appears to be attached to one point on the cyst wall.

Cut Tendons.—The flexor tendons to the fingers and thumb require careful repair under full operative conditions and the average casualty department has neither time nor resources to do it properly. The responsibility of the casualty surgeon is to diagnose the damage. Many patients, who may benefit by primary suture of cut flexor tendons, or by other definitive procedures such as tendon graft carried out soon after injury, are condemned to what is often a less successful operation, because the nature of the damage has not been properly appreciated when the case is first seen. The casualty surgeon has an opportunity of picking these cases out and ensuring that they receive early definitive treatment.

If the possibility of tendon damage is constantly borne in mind it will become automatic to require a full range of active movement from each patient with a suspicious laceration. Small children often need much coaxing and they are unable to co-operate enough for the production of individual finger movements With a little experience it is possible to detect the movements in individual interphalangeal joints while the fingers are vaguely moved about and this, though admittedly less satisfactory than obtaining full range of active movement, may have to be accepted.

A definite opinion should have been formed on the presence or absence of flexor tendon damage before a lacerated wound of the hand is explored, for the surgical approach, and indeed the disposal, may be entirely different in the two types of case. The early treatment of these, as of compound fractures, depends very considerably on the circumstances. If In-Patient treatment is readily available, the casualty surgeon's responsibility ends with a reference to the right quarters. If his situation is such that early suture of the tendon is unlikely, he should ensure that the wound is provided with complete skin cover and first intention healing,—and in fact, treat it as if the tendon damage did not exist, while appreciating—and recording—that it does.

Rough attempts to hold the tendon ends together, or to draw down the retracted proximal end, or to do anything short of a properly constituted tendon repair with the proper suture materials, are worse than useless. They add further damage to the tendon and the sheath, making any secondary operation more difficult and possibly less successful.

The wound, therefore, will be allowed to heal if tendon suture cannot be undertaken within a few hours of injury, and it must be noted that these cases often take longer than the usual five to eight days because the tendon

late neglected wound. Conservative treatment with splintage, possibly combined with secondary suture of the skin when the infection is controlled, restores full function in a sufficient number of cases for it to be tried in all.

Case History

A commercial traveller cut the back of his hand over the centre of the third metacarpal. He treated the cut at home. On picking up a suitcase five days after the cut he felt something snap under the open wound and his middle finger became useless. At this stage he was referred to the casualty department. There was a punctured wound on the dorsum, showing much surrounding acute inflammation. The middle finger was incapable of the last 45 degrees of extension, but if the proximal segment was fixed in full extension, movements of the distal segments were full. Without support no more than half the range was obtainable in any joint. This behaviour is typical of complete section of the extensor digitorum communis. The movements which remain are those produced by the combined action of the intrinsic muscles.

It was presumed that the original injury had resulted in partial section of the extensor tendon. Inflammation combined with undue effort in lifting the suitcase had resulted in complete rupture. The inflammation contraindicated an attempt at suture at the stage when the case was first seen, and his hand was put into a splint which gripped the proximal segment of the middle finger, holding it firmly in full extension. The remaining joints were held half-flexed. The infection was readily controlled by penicillin, and the wound healed in seven days. Splintage was maintained for three weeks. At the end of this time there was extension within 10 degrees of the full range, and the only other discernible disability was adhesion of the tendon to the healed scar. The patient announced himself sufficiently satisfied to decline a tendon shortening operation to restore the lost 10 degrees.

Section of the central slip of the extensor tendon by a wound close to the metacarpo-phalangeal joint is one of the most frequently missed minor injuries, mainly because it is expected that such an injury would produce a greater "drop" in the finger than actually occurs. It is often forgotten that very much of the finger extension is provided by the small muscles, including up to 45 degrees extension in the proximal phalanx. If the hand so injured is carefully inspected when full extension is attempted it will be seen that the finger always fails to draw up in line with the rest, though the amount by which it fails varies within rather wide limits. The importance of early and accurate diagnosis of this condition does not rest on the amount of damage to the tendon alone. If the tendon is damaged, it is almost certain that the wound involves the metacarpo-phalangeal joint, for the tendon in this area is the sole provider of the fibrous cover for the joint, and the synovial membrane is attached to its under surface.

So far as the tendon damage itself is concerned, this is another state of affairs where an assessment must be made of the *improvement* in function which can be anticipated, against the length of treatment and temporary incapacity which are necessary to obtain it.

If an attempt is made to repair the flexor profundus by suture it is almost certain that it will interfere with the movement of the proximal interphalangeal joint. As a result, though all joints move to some extent, attempts to clench the fist leave the affected finger sticking out from the others. It is liable to further damage, and is a source of clumsiness when the patient returns to work. It is thus possible that operation on the tendon may make the function of the hand as a whole less satisfactory than if a simple suture of the skin wound is carried out. Most workmen will prefer to be back at work in ten days with a good firm fist than to undergo prolonged treatment with a result of doubtful efficiency.

These injuries are frequently not diagnosed until the wound is healed, and then it is almost always advisable that no operation is carried out.

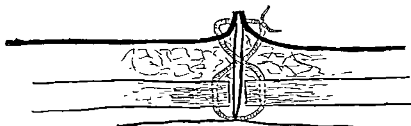


FIG. 87

A severed extensor tendon will unite if its ends are drawn together by nylon sutures which come to the skin surface A splint will relieve the tension The wound is also precisely closed by as many skin sutures as are necessary.

The Extensor Tendon.—There are no synovial sheaths about the extensor tendons, distal to the wrist. They are surrounded by a lax fibro-fatty tissue which allows great play. Suture of cut extensor tendons is not associated with the same tendency to bad results that accompanies suture of the flexors Peri-tendinous adhesions do not form so strongly and they stretch more easily. The extensors of the fingers are interconnected in a variable and complicated way on the dorsum of the hand. If a single extensor tendon is cut distal to the various interconnections they prevent much retraction of the proximal end so that there is very little tension on a suture line.

A cut extensor tendon in the hand or fingers can be sutured at the same time as the accompanying wound if there is a reasonable prospect of uncomplicated healing. The skin stitches can be used for drawing the tendon ends together, and the slight tension on the suture line can be largely counteracted by splinting in extension. The stitches through the tendon are removed after three weeks, and ultimate restoration of full movement can be anticipated (Fig. 87).

Extensor tendons cut over the dorsum of the hand may unite even with no suture at all, if the affected finger is splinted with the proximal segment in full extension. This knowledge should not be applied indiscriminately, but is useful in treating cases which attend with established infection in a

4. If a wound is explored and unsuspected nerve damage is observed, which cannot be dealt with at once, the severed ends should be marked by a fine black silk thread in the tissue alongside them (*not* through them), the tissue on each side bearing the same relationship to the nerve. Thus, where neurovascular bundles such as those along the sides of the fingers are severed, the digital artery is secured at each end with a black silk ligature instead of catgut, and the two silks are tied together. The two ends of the digital nerves are thus brought and held against one another without further damage, and are more easily identified when a second operation is undertaken. (The repair even of digital nerves is considered by many clinics to be a worth-while undertaking.) If no vessel is convenient fine stitches are put into the adjacent tissue and approximated.

The pre-operative diagnosis of peripheral nerve injuries is fraught with more difficulty than is generally recognised, and very great care is required. Even with care, it may be impossible to make an accurate diagnosis in every case and a repeated examination a few days later may be necessary. Patients are often unable to co-operate to that intense degree which is required in order to detect the finer grades of anaesthesia or muscle weakness. They are at that time less concerned with the anatomical details of their injuries than with its impact on their immediate concerns, and their replies are prone to be without proper attention. Secondly, an injured member "feels numb" *whether there is a loss of continuity in the nerves or not, and much misunderstanding results from it.* Local concussion of peripheral nerves puts them out of action for some time after the injury. Thirdly, the nerve supply to muscles and superficial surfaces is more variable than is commonly described, and accurate diagnosis may have to be postponed to the operation itself. "Ulnarisation" of the hand, whereby three lumbricals instead of two are supplied by the ulnar nerve, is a well-recognised variation, but it is less well known that it can proceed to further extremes, and in particular that the opponens pollicis can derive sufficient supply from the ulnar nerve to be entirely unaffected by complete section of the median at the wrist. These cases are, of course, rare, but an immediate assessment of interference with motor nerve supply to the hand is occasionally very difficult.

This overlap or extension of the influence of the ulnar nerve affects the cutaneous supply also, for complete section of the median is occasionally seen in which the sensory loss is much less than might be expected, or in which it "recovers" after suture in far less time than can be explained by nerve regeneration. Some degree of overlap is almost constant, and unless the nerve injury is a high one, the area of sensory loss is usually less than the area of anatomical supply. Recent nerve section may also be overlooked because not all forms of sensation are lost. There is nearly always survival of some degree of pressure sense, and a pin prick or a rough test for touch may evoke a response. Loss of *very light* touch (with cotton wool) is reliable, and so is loss of discrimination between two points applied *together.*

In cases seen early, with an open wound, suture of the wound is necessary. Prompt healing must be obtained, both on general principles, and especially because primary healing of the skin wound is the most effective prophylactic against suppurative arthritis.

The prospect of obtaining primary healing is not usually reduced by including the cut edges of the tendon in the skin suture (Fig. 87). Splinting in full extension assists healing of both skin and tendon.

An open suppurating wound, which may or may not (but often does) *involve the joint, must be treated for the infection. Here again a splint is* indicated, and if the infection is overcome a delayed suture of the skin may be carried out. At this stage the tendon is unlikely to hold a suture, but a splint in extension may encourage an end result with good function (cf. p. 125).

A healed wound, with a "dropped" finger, cannot be expected to improve its extension without operation. Failure to extend the last 5 or 10 degrees may not be regarded by the patient as a serious enough disability to warrant a month's treatment. If it is, or if the loss of extension is greater than this, secondary *suture of the tendon is indicated.*

Only too often patients do not attend for the treatment of cuts they regard as trivial until they are prompted by symptoms of joint infection. Cases seen early should have the most careful attention to even the smallest wound by toilet and suture in order to get prompt healing. Immobilisation and precautionary therapy with penicillin will assist to overcome the danger. Established joint infection is a heavy price to pay for a trivial wound whose misfortune it is to have occurred in a vulnerable place.

Injury to Peripheral Nerves.—The consensus of opinion is in favour of early suture wherever possible, and in complicated multiple injuries the prompt restoration of continuity in severed peripheral nerves takes priority immediately after the arrest of haemorrhage. Here again it depends very much upon circumstances whether the casualty department undertakes repair of these injuries, and it is impossible to lay down a policy which can be followed under all conditions. No more can be done than to enumerate the various factors which require consideration.

1. Nerve suture calls for the same conditions as tendon suture—a *good* theatre, plenty of time, anaesthesia capable of almost indefinite prolongation, and special, fine instruments and suture materials.

2. Primary suture to be successful should usually be carried out within eight hours of injury, and the earlier the better.

3. A rough attempt at suture is worse than doing nothing at all. If the ends are further damaged by handling and penetration they have to be cut away at a second operation until undamaged nerve is displayed. It leaves a *gap which is difficult* to bridge, and which *militates* against successful regeneration.

Most patients can be assured that there is a good prospect of considerable improvement within two or three months. They must be warned on their liability to further damage, especially by burns (they should be told to hold a cigarette in the other hand). They are invited to report back in three months if their inconvenience persists so long. That they do not do so may be interpreted as showing either that recovery has occurred, or that they have decided the inconvenience is not sufficient to warrant further treatment.

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Most nerve injuries should be admitted for In-Patient treatment. In those cases where it has been decided that treatment can be completed in the department, a reassessment of the case, when the superficial wound is healed, may prove to be informative—and occasionally surprising.

Injury to the Digital Nerve.—Special mention must be made of injury to the digital nerves because lacerations of the fingers, excision of tumours, and septic conditions (or operations for septic conditions) result in interruption of continuity in a certain number of cases. Anaesthesia of half of the finger, or even of no more than half of the distal segment, is important. It is rapidly recognised by the patient, and the casualty officer will be required to give a prognosis, and perhaps to advise on further treatment.

The digital nerve is stouter than is generally supposed. It is easily recognised in the bloodless field, and end-to-end suture calls for no greater precision than is demanded, for instance, in ophthalmic surgery. Three fine silk sutures suffice to bring together the cut ends of the nerve sheath.

Cleft anaesthesia (that is, of the adjacent sides of two fingers) from penetrating wounds of the palm or web space, should be treated by such an anastomosis.

Injury to more distal parts of the nerve may also give good results from suture, but here the indication for operation is less definite. There is much overlap between the dorsal nerves, supplied by the radial, and the volar branches of the median or ulnar. Complete section of the volar digital nerves in the middle and distal segments may be followed by considerable functional recovery in two or three months. Some cases in which unsuspected anaesthesia after injury is first reported during convalescence, recover much more quickly than this and it is probable that they have been due to incomplete division or physiological interference (" concussion "). Although therefore, surgical repair is a feasible procedure, deliberate operations should be postponed for *some weeks to establish that the complaint is likely to be permanent.*

Destruction of nerves by sepsis is very unusual. It is common to see nerves traversing abscess cavities on the lateral aspects of the fingers, in web spaces, and the lateral parts of digital pulp abscesses, and their function remains unimpaired even when the infection is extensive and virulent. Hasty incisions into congested subcutaneous tissue may, however, injure them, and this is to be avoided by operating deliberately, in a bloodless field, and by drying out all pus and exudate stage by stage as exploration of the cavity proceeds (p. 6).

Accidental division of a digital nerve, while operating for the removal of tumours, should be treated by immediate resuture if the materials are available. If the damage is not diagnosed until after the operation, a decision should be postponed until an opportunity has been given to assess compensatory spread from the unaffected areas.

in order that suitable antibiotic cover can be used on the day of operation, and for a day or two after (p. 6). Even this antibiotic therapy is not always necessary, and many cases which have acquired organisms bacteriologically resistant to all available antibiotics can be carried to successful healing without any antibiotic cover at all. The important parts of the operative process are the removal of granulations immediately before application of the graft, and perfect haemostasis of the recipient area.

Skin grafting, like wound suture, is therefore primary or secondary. Many opportunities for primary skin grafting are neglected, and a decision to undertake a secondary skin graft is often unnecessarily delayed.

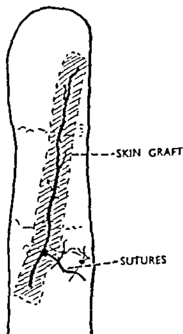


FIG. 88
A ragged laceration on the volar surface of the finger, down to and including the flexor sheath. The tendon, though exposed, was intact. Precise suture would almost inevitably result in some sloughing and sepsis. One arm of the laceration was sutured. The other was covered with an immediate skin graft.

Lacerated Wounds treated with immediate Skin Graft.—It is not only those cases where an area of skin has been entirely torn away that profit by immediate grafting. Many complicated lacerations, especially of the hand and fingers, cannot be sutured precisely because narrow bands of tissue bring the stitches too close together; or because there has already been some swelling and contusion so that the subcutaneous tissue bulges between the sutures, while the sutures themselves must be inserted under tension and tend to cut through. It is better to leave such a wound unsutured than to deprive the remaining skin of its blood supply. It is better still to cover all the open areas with a strip of skin and to incorporate it with the dressing.

CASE HISTORY

A pitman attended three hours after an accident in which his right index had been crushed between tubs. A dirty complex laceration, of the shape shown in the diagram (Fig. 88), was present with much contusion of surrounding tissue, with many tags of thick cuticle hanging on to the edges of the wound, and with extensive disruption of the fibro-fatty tissue of the middle volar compartment. Both flexors were intact, but the sheath over them was torn and deficient for about one-third of an inch.

Under general anaesthesia the wound was carefully cleaned, and all tags of cuticle, all severely bruised fibro-fatty tissue, and the severely contused parts of the wound edges were cut away. The wound lying more transversely was sutured with fine nylon. To suture the more oblique wound would have resulted in considerable flexion of the finger, and fatal tension on the acutely pointed lateral flap. No attempt to do so was contemplated. A split skin graft of adequate length and width

CHAPTER VIII

SKIN DEFICIENCY

APPROXIMATELY 90 per cent. of lacerated and incised wounds are seen early, and precise suture will accurately reconstitute the surface. The development of infection in this type of case should be very rare. The remainder—those with much contusion of tissue, those associated with abrasions, those seen on the following day, or even later—are more liable to secondary breakdown and to degeneration into granulating wounds. Certain tumours (such as dermoid cysts) may involve the skin and destroy part of it. Abscesses which have been allowed to "point" may leave a large area where the skin is no longer viable, and a granulating ulcer develops.

The disadvantages of granulating and discharging wounds, both to the patient and to all the other patients in the department, have been sufficiently emphasised to need no further repetition. *The proper dressing for a skin-less area is more skin,* and if it is unlikely to be provided in a few days, the loss must be replaced.

This is not a new conception. It has long been recognised that *extensive* areas of skin loss must be treated with skin grafts; but casualty departments are slow to accept that *small* areas profit by them just as surely. It is also well enough known that extensive granulation tissue should be grafted, but less well known that many other tissues, freshly exposed, will take a graft at least as successfully, and often better. Subcutaneous fat, deep fascia, and even muscle can be grafted immediately. Bone covered by periosteum (p. 168) will often accept a split skin graft (Tendons, cartilage, and bone without periosteal covering are inhospitable.) It is therefore not necessary to wait for the development of granulations, and immediate grafting should be considered in cases of skin loss where granulation will supervene if it is not carried out.

Nor does the presence of infection in granulations necessarily indicate delay. Many cases are allowed to granulate for prolonged periods because culture from the surface indicates the presence of pathogenic organisms When this delay is countenanced contractures progress unnecessarily and disability periods are prolonged. If such infected granulations are removed before the application of a graft, and haemostosis is secured, a good prospect of success may be expected. Two or three days' preparation of the wound by frequent saline dressings is often as effective as any other local application. It has already been stressed (p. 3) that to hope for the sterilisation of such granulations by the prolonged use of the "appropriate" antibiotic is vain. This period of preparation may, however, be utilised for obtaining culture reports,

tissue and grafted at this stage. To wait for complete separation of a slough is to wait for infection. Nothing is gained by doing so.

Planed Finger.—Woodworkers with mechanical tools suffer shearing wounds which entirely remove an area of skin and subcutaneous tissue.



Fig. 89
Washing machine injury. Avulsion of the skin from the dorsum is often retrograde and caused by the patient dragging her hand out against the rotation of the rollers. A considerable proportion of the proximal part may slough. The amount which needed skin graft is shown in this photograph of the healed result.

Wounds from chisels are sometimes similar in appearance, and a finger end may be entirely nipped away in a slammed door. Immediate application of a thin (Thiersch) graft, or a whole thickness (Wolf) graft, results in first intention healing, a good pliable scar, and a return to work in ten days or a fortnight. Repeated dressings without graft result in a recovery whose length depends to some extent on the area of the damage, and to some on the degree of secondary infection in the granulations. Primary skin graft is at least as successful as grafting a granulating wound seven or eight days after injury, provided it is

was cut and secured (see skin graft dressings, p. 136) over the distal laceration, and the whole covered with cotton wove bandage.

A.T.S. 1,500 U. and penicillin 300,000 U. were given before operation. The penicillin was repeated daily for five days. There was delay in healing because the wound remained soaked in synovial fluid for the first week, and a finger splint was maintained for twelve days after the operation. At no time was there any sign of infection. Three weeks from the accident the wound was quite healed, and four weeks from the accident movement was full and the patient was fit for work.

The Sloughing Skin Flap.—Shelving wounds, especially if associated with much contusion, may fail to unite because of impairment of blood supply at one side. It may be impossible to be sure when the case is first seen that this will take place, for thrombosis in the vessels, or increasing reactionary oedema may advance the condition after suture has been carried out. Such injuries are by no means confined to workers in heavy industries, or confined to the male. The modern electric washing machine is a frequent source. In these the hand is seized, lacerated, and rolled. The wound is usually on the dorsum of the hand or forearm, the extensor tendons usually remain intact, but the skin flap itself is long, pushed up the hand towards the wrist, and severely compressed as well as extensively lacerated. Occasionally such injuries have the base of the flap attached distally, and are caused by a panic-stricken withdrawal of the imprisoned limb against the rotation of the rollers. Flaps with *distal attachments under these conditions almost always necrose if they* are simply replaced and sutured (Fig. 89). The skin has a much better prospect of survival if it is re-attached after every scrap of subcutaneous fat has been removed. It then behaves as a whole thickness graft, and is attached under normal tension. A similar process may be necessary for the distal part of a flap which has its base at the wrist, and a very fine judgment may be called for before it can be determined what proportion of tissue can be relied upon to behave as a pedicled flap, and what proportion as a whole thickness graft.

In many cases such a determination cannot accurately be made at all, and there is doubt about the viability, rather than certainty that necrosis will occur. In them careful toilet and resuture will give an opportunity for healing, for when the flap is straightened out and returned to its normal tension there may be improvement in the vascularity. Firm bandaging, comfortable splintage, and a sling will help to control reactionary swelling. If the flap so replaced is obviously blanched, the tension should be relieved as much as is necessary by removing enough sutures to restore the circulation. This, of course, leaves a gap, and it is to be covered by an immediate skin graft.

The same choice of procedures is available when similar injuries occur to the palm of the hand Here the plane of damage is usually at the surface of the palmar fascia.

The wound, whether grafted or not, is inspected about the fifth day. If there is any necrosis the area should be excised down to healthy bleeding

away after many days, and then will reveal granulations which can accept a graft. If it is treated by immediate grafting to the abraded surface the graft often fails. If a thin layer from the surface is sharply excised and haemostasis is secured by pressure, an immediate graft may be expected to take promptly and to give first intention healing.

Most of these injuries occur on the dorsum of the hand or fingers, and extensor tendon damage may be associated. If soft tissue can be drawn across the exposed tendon, there is a chance of success. The possibility of using a pedicle flap must also be considered, though this is an indication for In-Patient treatment. Tendon repair should be deferred to a later date, but splints may be used to maintain extension as well as to accelerate healing (p. 125).

In these grafts, attention to the details described above is of more importance than the exhibition of antibiotics, and in the great majority of recent lesions the antibiotics are quite unnecessary.

The Technique of Simple Skin Grafting.—It is obviously necessary that a department which uses skin grafting to an increasing extent for the elimination of granulating wounds and for rapid first intention healing must develop a simple technique for cutting, applying, and securing the graft. Each department tends to develop a routine of its own, and the one to be described may be considered in no way superior to the rest. Nevertheless, there must be some routine, so that it can be employed frequently, and so that an unexpected decision in the middle of an operation to employ a graft may not result in confusion and delay. Unless grafting can be done swiftly and simply, its popularity for minor procedures is unlikely to increase.

No special instruments or apparatus are required. There is no place for the elaborate ritual of the dermatome in the casualty department. The only graft commonly required is one about three-quarters of an inch wide, and most of the wider areas need no more than two such strips laid side by side. They can be cut freehand from the outside or front of the thigh with a 22 blade on a Bard Parker knife. Two or three blades should be available, as they vary in sharpness (Fig. 132). Skin tension is provided by an assistant (not scrubbed up) who grasps the back of the thigh underneath the towel with both hands in such a way that the front of the thigh is stretched over the femur and quadriceps to form a firm surface (Fig. 91). The skin is shaved and cleaned with ether. The surface is lubricated with a little liquid paraffin. Dry gauze in front of the blade provides the right inclination of the skin against it. A very little practice will enable the surgeon to cut two-inch lengths of skin, of even thickness, with no more apparatus than this. The donor area is dressed with dry gauze which is not disturbed until it drops off, and the gauze is covered with a cotton wove bandage secured to the thigh with two or three suspensory strips of strapping. The graft is spread on to a strip of petroleum jelly gauze at once, and applied to the surface. Securing it there constitutes at least half the secret of success, and direct fixation of the graft and

not applied to denuded bone, or to exposed tendon. Exposed bone can be trimmed down by about one-third of an inch, so that the soft tissue is brought over its end by the stitches which secure the graft (Fig. 90).

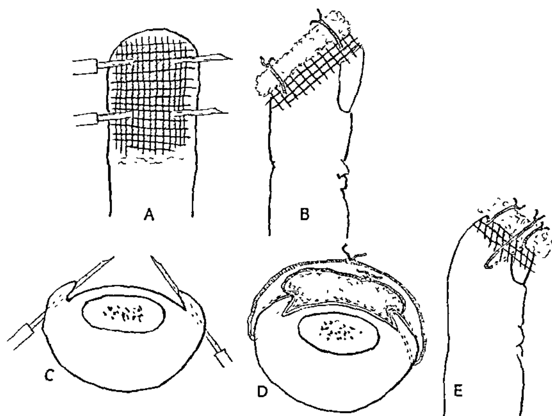


FIG. 90

Securing a skin graft to the finger end without using an occlusive bandage. The stitches transfix the petroleum jelly gauze, split skin graft, and soft tissue (A). They are tied over a pad of paraffin-flavine-wool (B). Where injury involves nail bed one stitch is passed through each lateral pulp space (C). Both ends of each stitch are tied over the dressing (D) The distal stitch is usually a simple through-and-through (E). Cotton bandage over all allows evaporation, increases the prospect of a successful graft, and allows freedom of movement without disturbing the graft (See also Figs 116 and 117.)

Whole thickness grafts are preferred to split skin in some clinics. They give a better cover with less tendency to contraction. On the other hand, they are less certain to take, they require very careful removal of subcutaneous fat *if they are to take at all, and they demand very careful suture into position.* For most of the work in casualty departments, where ten or twelve operations may have to be undertaken in a small section of the working day, the thin split graft is to be preferred (see Fig. 120, p. 172).

Emery Wheel Abrasion.—This is a somewhat similar injury in that it results in skin loss which should be replaced by grafting at first intention. It differs from the foregoing in that the tissue is often burned by friction as well as abraded away, and for this reason the remaining wound may be lined with non-viable tissue. If it is treated expectantly this surface may slough

effective than any other, because the danger of displacing the graft while the member is being bandaged is reduced to a minimum. Secondly, the pressure is applied only where it is wanted, and counter pressure is obtained by the

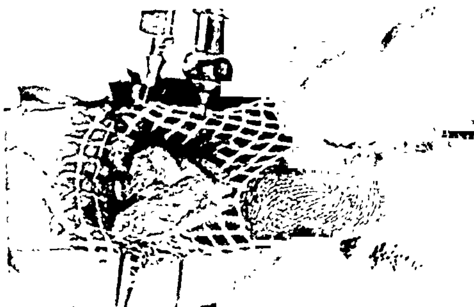


FIG. 92

A simple method of securing a small graft is to pass hypodermic needles through gauze, graft, and the base of the wound. Nylon threads are then passed backwards down the needles. The needles are then withdrawn and the threads tied over the dressing. (This is the same case as Figure 1.)

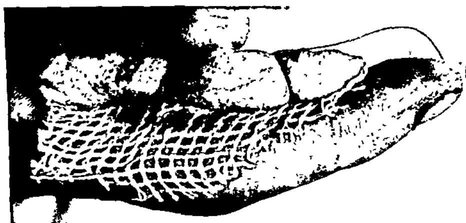


FIG. 93

The threads are tied firmly over a pad of cotton wool soaked in paraffin and flavine emulsion. Open wove cotton bandage is used as cover, to allow evaporation.

stitches. Other methods demand pressure applied to the rest of the member to an equal degree. This may result in swelling distal to the constriction, and even seriously endanger the circulation, especially if there has already been damage to some of the vessels by the injury. Thirdly, the common method of fixation, by pieces of elastic adhesive applied in two or more layers, in

petroleum jelly gauze to the recipient area with fine nylon sutures is the method of choice. If the situation demands that they be sutured with skin needles, the stitches pass through graft and gauze together, and all stitches are left long. Linear grafts on slightly convex surfaces may be secured by passing two or more hypodermic needles through the base of the area, both



FIG. 91
Free-hand production of a narrow strip of Thiersch graft. Tension is produced laterally by the hands of an assistant grasping the thigh at the sides and spreading the skin on the front The surgeon's left hand pulls the skin away from the blade with a piece of dry gauze, and inclines it against the edge. Towels have been omitted for the purposes of the photograph They should isolate the field from the assistant, who does not scrub up

edges of the gauze, and both edges of the graft. Nylon sutures are then threaded backwards down the needles, and the pressure dressing, of wool wrung out in paraffin and flavine emulsion, applied over them. The needles are then withdrawn and the threads tied moderately firmly over graft, gauze, and wool (Figs 90, 92, and 93). Slight modifications of this technique are applicable where the surface is too convex for a single needle to be run under it (Figs. 90, 116, and 117)

If the threads are applied by suture needles, their long ends are tied back over the paraffin and flavine wool.

These dressings are then covered with dry gauze and open wove bandages, applied firmly but not tightly.

To secure the graft by local pressure and to secure the dressing by stitching it to the wound have three great advantages. Firstly, the method is more

down the principle that pressure necessary to get a graft to take ought to be applied to the region of the graft, and to nowhere else.

Where multiple grafts have been applied, as by the "postage stamp" method, suture of each individual graft becomes impossible. Sometimes a



Fig. 95
When elastoplast is used to fix a dressing it should be stretched the required amount before it is applied.



Fig. 96
If elastoplast is fixed at one end and stretched as it is brought over it displaces the dressing sideways. A graft underneath may become creased or displaced.

layer of petroleum jelly gauze can be stitched to the limits of the grafted area, and the peripheral stitches are then used to secure the dressing and apply the counter-pressure. Sometimes fixation by adhesive bandage may be necessary. A petroleum jelly gauze dressing over the whole area, smoothed down with a generous overlap at all edges, has sufficient adhesive quality to hold the grafts in position while they are further covered with paraffin and flavine wool. The whole dressing is then held down by an elastic adhesive. This is applied while it is on the stretch, because there is less danger of disturbing the graft in this way (Figs. 95 and 96). If it is fixed to one side of the wound and stretched

evitably means an occlusive dressing over the area for five or more days, and leads to maceration of the surrounding skin with its increased danger of infection. Local fixation allows a top cover of open wove bandage and a much drier wound. A dry graft heals more rapidly than a wet one whose cuticle is shed in the second week and whose deeper cells grow to maturity in moisture. A dry graft not infrequently adheres and survives *in toto* (Fig 94).

The whole area should be covered with skin, a generous overlap allowing fixation of the graft, as well as the petroleum jelly gauze, to the periphery of the wound.



FIG. 94
On removing the dressing six days later, the graft is dry and firmly adherent This patient, whose soft tissue loss exposed half an inch of tendon sheath, obtained full flexion and almost full extension.

CASE HISTORY (of a failure)

A butcher's assistant was sent within an hour of injury. His knife had sharply excised the majority of the lateral surface of his right index, taking away a strip of skin and subcutaneous tissue, and the digital neurovascular bundle over a length of one and a half inches.

Under anaesthesia the wound was well cleaned, and haemostasis was obtained by forcipressure but no ligature A single strip of skin was cut from the thigh, applied on petroleum jelly gauze to the area, and a pad of paraffin and flavine wool put over it. A strip of elastic adhesive bandage was applied to hold the graft in place and the nurse was instructed to apply more similar strips to complete the fixation.

Two days later the patient attended complaining of severe pain for which his doctor had given an analgesic. He was not referred to the casualty officer, but instructed to return to the clinic on the following day.

His next attendance was on his *fifth* post-operative day as he had " been too ill " to attend when instructed The dressing was removed. The finger was gangrenous. It was amputated. It is suspected that pressure from the dressing had obliterated the vessels on the medial side of the index, in a case where the vessels on the lateral side had been destroyed. A local pressure dressing over the graft itself would have left the vessels in the rest of the finger unobstructed, and adequate circulation would have been maintained.

An unusual chapter of accidents prevented removal of the constricting dressing in time, but this case, which occurred some years ago, was instrumental in laying

is removed, and provided it is sutured to produce approximately the same tension as is exerted on it in its natural position. If a whole thickness graft is used under the misapprehension that it is a split graft neither of these conditions is likely to be observed, and the first dressing five days after operation reveals a black slough, which often remains attached for some weeks until it is replaced by scar tissue.

The commonest cause of failure in grafting granulation tissue, provided that the infected granulations themselves are removed, is inability to obtain haemostasis. If they are not removed the commonest cause is persistence of infection. When they have been eradicated a fibrous surface is laid bare. It bleeds smartly. Local pressure with hot saline gauze reduces the generalised oozing to a few points, but these may persist for some time. Generally the graft can be applied, and pressed firmly home, before the skin is floated out of position. The under surface of the graft itself has a haemostatic effect, and continuation of pressure may succeed in arresting bleeding from these remaining points. If a haematoma forms under the graft the operation is doomed.

CASE HISTORY

A subcutaneous infection of the index attended five days after onset with two sinuses and extensive abscess cavitation of the lateral side of the finger. Discharge and necrosis continued after the usual toilet and evacuation of pus and slough (see the treatment of subcutaneous infections, p. 32). Much destruction of skin occurred. The wound grew penicillin sensitive staphylococci. At a second operation, ten days after the first, high penicillin dosage was used, all unhealthy, inflamed, and undermined skin was cut away, and the granulating base of the cavity carefully curetted. Haemostasis was obtained without ligatures. A single strip of skin, cut as described above, was applied so that it covered the area entirely. It was secured with petroleum jelly gauze and paraffin-flavine wool by the use of hypodermic needles running under the wound—avoiding, of course, the flexor tendon. One dose of penicillin, 300,000 U. was given the next day. Six days later the wound was redressed. It was dry and the graft had taken. Four days later still, the patient was discharged (Figs. 2 and 3).

Skin grafted areas are often very tender for some weeks after they are healed and the patient should be reassured that use does not do any damage even if it hurts. They should be advised to wear a light protective dressing over it when they are at work but to discard it at other times. In most cases an early return to work is an advantage.

Acceptance of the suggestions made in this chapter will result in a considerable increase in the operative work of the department, for it means that many cases hitherto allowed to recover by second intention will require anaesthetics and a surgical operation. It should, however, be acceptable to the majority of patients because it accelerates their recovery; acceptable to

as it is brought down, the dressing tends to be pushed across and may carry the graft with it. Much greater care is necessary when this method of securing the graft is called for, than by those methods which allow graft and dressing to be stitched to the wound in one piece. Retention of discharges, maceration of the surrounding skin and of the surface of the graft, and the possibility of eczematous reaction (Figs. 74 and 86) must all be accepted when fixation with an occlusive dressing is necessary. Therefore, its adoption should be confined to the more extensive grafts where the other methods are inapplicable.

A further occasion may occur when grafts are to be applied to the lower leg, especially in those cases already described as prone to gravitational ulcers (p 115). Here also the dangers of sensitisation eczema and maceration may have to be accepted (though they can be minimised by dressing the graft area copiously) and the advantages to the local circulation of a firm elastic bandage, or of a " viscopaste " dressing—from the toes to the knee, and no less—outweigh the disadvantages. This bandage is not, of course, applied merely to obtain fixation of the graft, though it is used as such. It is primarily a prophylactic against gravitational oedema in the recipient area, and is used for the same reason as it is sometimes used after suture. It destroys the chances of a " dry take " but this must be accepted.

Pinch grafts—" Reverdin "—are condemned by most plastic surgeons, but a word may be ventured in their praise. When the main object is to cover an area rapidly, when the cosmetic effect is unimportant, when scar contracture is unlikely, when it is uncertain that all infection can be overcome, and when, for any reason, it is unwise to remove all the granulation tissue, the application of pinch grafts may succeed when the chances of any other type are doubtful. Illustrations (p. 13) of the use of such grafts have already been afforded. Finally, they require no technical skill at all, which may or may not have merit.

Small pedicle flap grafts occasionally find a place in minor surgery of the hand and fingers, though there are very few occasions when a split skin graft will not give at least as good a result. They are indicated where early cover of an exposed bone or joint, or a denuded but valuable tendon, is required. The method of applying a flap to the finger pulp by flexion on to the palm of the hand is, however, not recommended, for fixation of the finger in such a strained position for ten or twelve days is painful and damaging Similarly, attachment to the opposite forearm is not recommended because it puts both hands at a disadvantage. Those cases where a pedicled graft is indicated—let it be repeated that they are rare in Out-Patient cases—should have it raised from the chest wall, where the hand can be held comfortably under the clothes.

The commonest cause of failure when skin grafting is attempted on fresh injuries is from cutting the graft too thick. A whole thickness graft will take quite well, provided every scrap of fatty tissue adhering to its under surface

is removed, and provided it is sutured to produce approximately the same tension as is exerted on it in its natural position. If a whole thickness graft is used under the misapprehension that it is a split graft neither of these conditions is likely to be observed, and the first dressing five days after operation reveals a black slough, which often remains attached for some weeks until it is replaced by scar tissue.

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the majority of hospitals because it reduces the number of post-operative attendances, the number of dressings, and the number of nurses required to do them,—and to the casualty officer himself because the performance of such operations is one of the most interesting, educative, and immediately gratifying aspects of his work.

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CHAPTER IX

BURNS AND SCALDS

DUPUYTREN'S detailed classification of burns and scalds into six degrees of depth has very little value to the casualty officer, and he can invent a classification for himself. The cynic has classified them into " those that do, and those that don't." He whose conclusions have led him no further than this has advanced far up the path of experience. The other practical basis for classification is into those he treats, and those he admits for treatment, and this is a division which is fortunately well defined. He admits anyone who is shocked, anyone burned or scalded on more than one aspect of the body (that is, who cannot lie entirely on an unburned part), anyone burned or scalded about the perineum, or severely about the face and neck, anyone who cannot remain ambulant in comfort, anyone whose burns are so extensive that Out-Patient dressings become an ordeal, and anyone whose burns are so deep and extensive that reparative surgery cannot be undertaken in the casualty theatre. None with as much as one-ninth of the body surface involved is likely to escape inclusion under one or more of these headings. Many children with very much less than this should also be admitted. Even comparatively trivial burns or scalds in children may result in severe haemoconcentration and delayed collapse.

Apart from such cases as these, about 1 per cent. of all the reasons for attending the casualty department are because of minor burns and scalds (Appendix I). In these a further consideration of why some " do " and others " don't " leads to a rational line of treatment.

The practical classification is into those with no true skin damage, those with partial damage, and those with whole thickness loss. Restated in terms of treatment, this becomes: those that will not require skin grafting, those that might, and those that will. Any burn producing more than insignificant whole thickness skin loss should not remain ungrafted, for if it does the patient will be condemned to an unnecessarily lengthy incapacity and an avoidable contracture. In terms of the Dupuytren classification, the dividing line lies between the third and fourth degree.

When it is first seen an attempt must be made to estimate if whole thickness loss has been produced, and it must be confessed that even with extensive experience it may be impossible to make an accurate decision. This inability must be taken into consideration in establishing a routine line of treatment. A few are obviously superficial, a few are obviously deep, but the majority that the casualty surgeon has to treat are doubtful, and he must be prepared to accept it. These are the cases also, where the damage done by heat can

very easily be increased by unwise treatment, and they can be converted from a favourable to an unfavourable outlook after he has accepted responsibility for them. This is most important. Many burns *become* deeper because they become infected. Islets of epithelial cells which have, by good fortune, escaped the fire, may, by bad treatment, succumb to the secondary suppuration. Vigorous scrubbing, other trauma, and fierce antiseptics have the same effect, as have watertight dressings and the rise in bacterial flora consequent on retained perspiration, sebum, and discharges.

Diagnosis of Degree.—Attention to certain points will be of assistance in deciding which burns fall into which of the three classes—the obviously superficial, the " doubtful " ones and the obviously deep. To admit that there is a " doubtful " class is not a confession of inadequacy. It has already been pointed out that certain borderline cases may become deeper if they are tipped in the wrong direction by over-zealous or inadequate treatment. Such a mishap cannot be foreseen when the burn is first inspected. Secondly, the early appearance of burns involving the true skin, but not destroying it entirely, is very like those whose physical effect has extended into the underlying subcutaneous tissue, and which if ungrafted will inevitably lead to sloughing of the whole skin thickness, the development of granulations, and ultimately a contracting scar.

It is important to pick out this last type of case as quickly and as accurately as possible because excision and graft, if applied early, are often outstandingly successful, and avoid many weeks of less successful treatment when the opportunity is lost.

On the other hand, excision and grafting are not recommended as the treatment of all the doubtful burns for obvious reasons, and one has to be reasonably sure that an excision is definitely indicated before undertaking it. To cut away viable tissue is a grave mistake, therefore the decision on whether excision is to be of benefit must be made as early as possible, and this decision depends entirely on an accurate diagnosis of degree.

Doubtful skin is red, tense, oedematous, the cuticle has been stripped off, or is rubbed off easily, and if it is further injured (which should not occur) it oozes blood-stained serum (Fig. 97). If it is treated with care, flecks of shaggy pale slough may be shed, but it is unlikely to be cast entirely, and in the second or third week islets of pink, epithelialising cells appear through the whole area, from which multifocal healing rapidly spreads to cover the intervening surface (Fig. 98). If it is not further damaged by frequently pulling the dressing away it may be expected to heal in two or three weeks. Dressings to the area itself are done weekly, though top dressings can be changed more frequently if it is desired. This type may leave a fine thin scar, but it has no pronounced tendency to contractures.

Skin which *may* have been killed is white and unyielding, with some underlying oedema and loss of all elasticity. It is anaesthetic and painless.



FIG. 97
A "doubtful" burn, on the second day. The central pink area is surrounded by a brighter hyperaemic zone. Circulation is present, though there is only slight colour change on pressure. Response to pain sensitivity tests was doubtful—in some parts normal, in some reduced, and in one or two small zones apparently anaesthetic. This case healed in three and a half weeks without grafting.

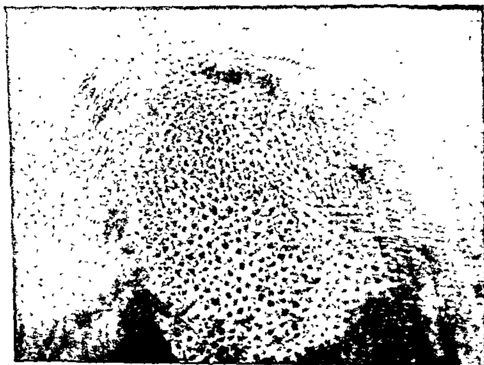


FIG. 98
A "doubtful" burn in the second week. Epithelialisation is established in the periphery. More centrally are bright pink islets from which multifocal epithelialisation is still *proceeding*. *This case also healed entirely without grafting*, and left a small, thin non-contractile scar over the central part. (*Photograph by courtesy of D. MacG. Jackson.*)

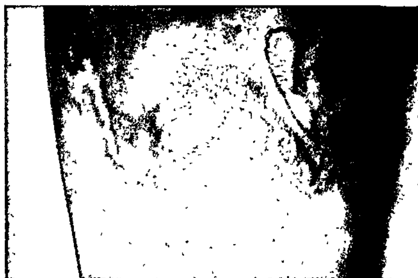


Fig. 99
An obviously deep burn two days after the accident. Three zones are seen: A Peripheral hyperaemia in viable skin B. A narrow zone of stasis in which a vascular circulation may be simulated by colour change on pressure C The main area of coagulation—anaesthetic, with no circulation, and with a charred surface. Part of the area is blistered, part is not The presence or absence of blistering is of no help in this type of burn. Sloughing of both zones B and C will occur The line of excision for grafting is between A and B This area was excised and grafted on the third day with healing in a fortnight



Fig. 100
Key to Figure 99

It does not ooze serum or blood. It shows no colour change on application or release of local pressure. Usually there has been no loss of cuticle from its surface. The deeper layers of skin in this condition *may* have escaped total destruction, and although superficial sloughing occurs, separation *may* leave enough islands of epithelium to cover the area in a reasonable time. It is more likely than the foregoing to lose these bridgeheads for recovery in the face of late infection, and more likely to leave a dense, contracting scar and resultant deformity.

If to this appearance is added much toughening of the surface, as with the searing effect of a hot iron, and if the punctae of the sweat glands and hair follicles, or the pattern displayed by the fine texture of the skin, have been destroyed, then it is reasonable to assume total skin loss, and to consider excision. Scorching, yellowing, browning, blackening, or cracking of the skin are equally good indications (Figs. 99 and 100).

The appearance of the burn must only be accepted as evidence of its severity with some reserve, for it indicates severity of damage to the surface layer only. It is not necessarily any indication of the depth, though of course, severe surface damage is more likely to occur with deep burns than with superficial ones.

Evidence that the dermal circulation is retained is not entirely reliable as an indication of survival, and this is particularly so in electric burns (p. 154). Loss of circulation is not an absolute indication of full thickness destruction.

The presence of pain sensitivity (not touch) to pin prick is probably the most reliable sign that there is some survival of epithelium-forming elements at the deeper levels. For the casualty department at least, primary excision of any burn which retains this function is a mistake. Particularly in such areas as the back of the hand or foot, or on the limbs or trunk, loss of pain sensation is reliable in helping to decide that full thickness loss has occurred. On the other parts—face, scalp, palms and soles—loss of pain sensitivity may occur without complete destruction of the skin, but it is improbable that primary excision of such important areas would be considered in a casualty department in most circumstances.

The deepest damage usually occurs in the middle of the burned area, and many burns of the "doubtful" class therefore show concentric zones. These have been exactly described, and their progress under treatment traced by Jackson at the Birmingham Accident Hospital. His paper on the diagnosis of depth is of the greatest importance to those who have to come to an early decision on the disposal and treatment of burns cases. His diagrams illustrate how two burns with similar surface appearances may have *entirely different* prognoses. He emphasises the value of the response to pain stimuli in deciding for primary excision or against it (Figs. 101 and 102).

When all this has been agreed, and when innumerable photographs (only some of which are reproduced) have been studied, one returns to the incon-

testible fact that all attempts at classification and description result at one time or another in surprises and disappointments. No disappointment, however, is a permanent one, if one is prepared to change one's estimate of the "doubtful" burn as soon as there is evidence to justify revision. A skin graft

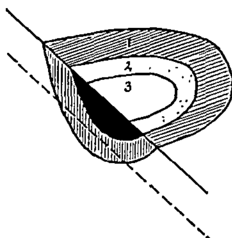


FIG. 101

Partial thickness skin loss A diagram illustrating the three zones of intensity (1) Peripheral hyperaemia. (2) Intermediate vascular stasis. (3) Central coagulation. The two inner zones (shaded black) do not penetrate the skin (*Diagram by courtesy of D. MacG. Jackson.*)

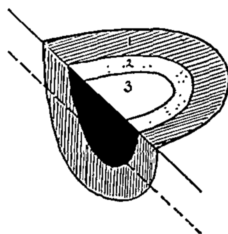


FIG 102

Whole thickness skin loss The same surface appearance is associated with complete skin destruction The zones of necrosis (shaded black) penetrate the full thickness of skin.
(*Diagram by courtesy of D. MacG. Jackson.*)

on a small burn is too often regarded as a last resort, after a council of despair. It should be a normal procedure, employed promptly, as soon as there is a proper indication for it.

Early Treatment of superficial Burns and Scalds.—The whole area is carefully and *gently* cleaned with a detergent, then as carefully and gently dried with sterile gauze. Any cuticle which is entirely loose is removed. Very

often blisters have burst at one side only and the burst edge becomes reattached to the burn nearer the centre. Attempts to pull this away do unjustifiable damage to the surface, and such areas of cuticle should be left alone. Respect for the cuticle is greatest for that on the volar surface of the hands and fingers and the sole of the foot (Fig. 103). This should where possible be replaced or preserved as a protective, but here again no attempt is made to pull it back into position if it adheres in the wrong place. No additional trauma to the



FIG. 103

Blisters on the palm of the hand, however impressive, should not be pricked, and raised cuticle should not be removed. Although the presence of a blister may be deceptive (Fig. 99) the fact of *excessive exudation* suggests that some of the dermal elements, at least, *have survived.* The photograph was taken five days after the burn. Three days later the blister burst. Careful toilet with a detergent and a copious dressing are all that are indicated. This case progressed to complete recovery within four weeks.

burned surfaces can be accepted. The multiple blisters common on the back of hairy hands and forearms are not molested (Fig. 104) but their surface is cleaned with the rest of the area. Large blisters may be punctured, but this is not always necessary.

The area is dusted lightly, on this one occasion only, with penicillin powder (5 per cent. in lactose) to combat any residual infection, and a layer of petroleum jelly gauze, well rubbed out, spread over it, and pressed firmly home, so that any serum can squeeze through the meshes and be dried away with sterile gauze.

Another layer of petroleum jelly gauze, similarly relieved of all excess of petroleum jelly, is placed over the first, as accurately as possible, so that its fibres do not lie over the gaps in the first layer, and so that there is no danger of

the two layers forming an occlusion between them. Gauze and wool in sufficient quantity are put over, and the whole secured by one or two layers of open wove cotton bandage, with a sling where indicated. This method of applying petroleum jelly gauze allows the burn and the dressing to dry in a short time, and as long as it is dry there is little danger of infection.

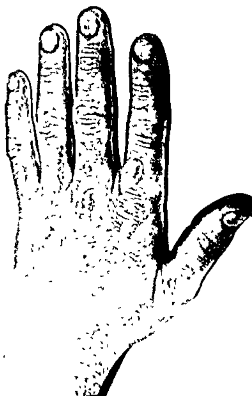


FIG. 104
These blisters on a superficially burned hand should be left unpricked. The whole hand is gently cleaned and covered with a dressing of well-rubbed-out petroleum jelly gauze. The fingers are bandaged individually—a "glove," not a "mitten"—to allow movement. The fluid will absorb and the cuticle will dry in a few days.

The patient is sent home with a suitable analgesic, and instructed to attend at any time if "anything comes through." If this occurs further dressings are applied over the existing bandages. In any case he attends on the fourth or fifth day.

By this time wool, gauze, bandage and any second layers of wool and bandage have dried into an inseparable mass. Traditionally this has been treated by soaking in warm baths while the patient picks pieces of it off with his fingers—and the stage is set for a secondary infection. Use of the two layers of petroleum jelly gauze, accurately placed as described above, avoids this ordeal and danger. Any bandage not involved in the "caking" process is

cut away, and the dressing is raised at one edge until a plane of cleavage is found between the two layers. The whole of the mass can then be removed dry, leaving one layer still attached to the burn, and the area laid open for inspection quite painlessly (Fig. 105).



FIG. 105
Removal of the superficial layers of a burns dressing by cleavage between two layers of petroleum jelly gauze. The deeper layer adheres to the burn in those areas where healing is incomplete. The superficial layer carries away all exudate and allows a more flexible dressing to be applied. No disturbance of the burn itself is necessary at this stage.

If the burn is not healed, a light gauze and cotton bandage are applied, the patient begins active exercises and use of the member (because the stiff caked dressing has been removed) he is instructed to attend again in three or four more days, and to keep his dressing dry. For cases progressing favourably this treatment may be continued until healing is complete. The majority of the area generally heals in a few days, and the gauze is lifted carefully away, unless and until some patch begins to show a moist surface. This adherent area should be left in position, and only the freed parts may be cut away. The first dressing is retained, therefore, unless sepsis, granulation, or sloughing occur. In most cases on the seventh or eight day the patient

is ready for dismissal, having already had three days of use and having already enjoyed a considerable return of function.

Early Treatment of the "Doubtful" Burn.—The treatment on the first day of attendance is exactly the same as in the foregoing, as is any attention required for soaking through the dressing.

When the top dressing is removed at the plane of cleavage an estimate can be made of the severity of the burn, without removing the layer attached to it. Great importance is attributed to the fact that this layer can be retained on the vital fourth and fifth days, when any rough handling of the surface may destroy the rejuvenating epithelium. Only if it is obvious that the surface will slough is any further attention indicated. By far the majority of these "doubtful" cases will be observed to develop the multiple red, epithelialising areas already described (Fig 98). They should not be disturbed until healing is further advanced, or until definite granulating areas are established. If much discharge is anticipated, a second petroleum jelly gauze layer is put on before the dressing is completed. Here again active movements can be enjoyed because there is less "caking" of the subsequent dressings than of the first one.

By the time the eighth or ninth day has arrived, that is, at the third inspection, it will often be quite clear how the case is going to develop. The healing case will be epithelialising well, with perhaps one or two areas still in doubt. The blistered cuticle which has been left undisturbed will have shrivelled up and can be snipped away with scissors, because evaporation from the area has been free Treated in this way, most "doubtful" burns are healed within a fortnight, and very often the layer of petroleum jelly gauze originally applied to the surface can be retained for all this period. Two changes of top dressings are often enough.

In a few cases, it may be apparent within this period, that part of the area will slough; then the burn is covered with a temporary dressing, suitable arrangements are made, the final layer of petroleum jelly gauze is removed, the slough is excised and the area skin grafted.

In cases where the burn is a severe one, but where certain of the most deeply situated epithelial elements (in hair follicles or sweat glands) have escaped destruction, it may take as long as three weeks to decide whether grafting is necessary. If any area larger than a shilling granulates at any stage, the granulations are scraped down to the base and a split skin graft applied.

Petroleum jelly gauze should not be kept on a granulating area longer than ten to fourteen days because the granulations grow through the mesh and are torn away when it is removed. If the policy advocated in this chapter is adopted, it will be only in the most exceptional circumstances that granulations are allowed to remain ungrafted for as long as this. Such occasions are usually

confined to those patients who continue working with their burns, and refuse further operation.

The Deep Burn.—Burns which obviously involve the whole skin and some subcutaneous tissue, and which do not merit admission to hospital are rare; but they do occur occasionally, and they are not necessarily unsuitable for treatment as Out-Patients solely because of their depth. Burns from electric fires may be deep but not extensive, and prolonged contact of a small area of skin against hot metal, such as may occur to epileptics and the feeble, produce similar lesions.

Immediate treatment by excision of the burned area down to healthy subcutaneous tissue, and a skin graft (or, occasionally, primary suture) may be considered in these cases. If tissue inhospitable to split graft is involved (bone, cartilage, or tendon) a hinged pedicle graft is indicated, and it is unwise, and almost impossible, to carry treatment to a conclusion in the casualty department. A decision should be made early. In-Patient treatment should be arranged before the establishment of a deep, adherent slough leads to infection and makes subsequent grafting operations more hazardous. There is never again as good an opportunity to obtain an aseptic graft as there is immediately after the burn.

It may be impossible to treat large burns in this way because of shock, or because it is difficult to find enough skin; but in smaller ones, such as a casualty department is likely to treat, this problem does not arise. No opportunity should be missed. The results are at least good enough to justify the attempt. At the best, 100 per cent. of the graft takes at once, and the burn is healed within the fortnight.

It is, however, a grave error to undertake an unnecessary primary excision, and to avoid this it is advisable to keep the class of "doubtful" cases a large one until sufficient experience has been gained. A delay of a few days, therefore, may be acceptable in order to establish that the indication for excision is unquestioned; but where there is no doubt that the burn is a deep one, such delay is quite unnecessary. The common tendency at first is to underestimate the degree of severity. Perhaps this is fortunate, for there is less danger that one is tempted into an excessive number of primary excisions. Later, one may overcompensate after realising the initial error. When one comes to recognise the appearance of severe superficial damage, one may at the same time come to believe that all such burns have full thickness loss. It is probably at this stage in one's experience when too many primary excisions are attempted.

If it is decided to excise a recent burn, it should be as entire an excision as possible. Often the burn is definitely full thickness in the centre, and doubtfully so at the periphery (Zone B, Fig. 100). Nothing is gained by preserving the doubtful part, for it often leads to a border of septic slough around the graft which requires further grafting later on.

Electric Burns.—Burns which are associated with an electric shock, such as those from a high tension cable, or from contact with the element of an electric fire, may produce a deep lesion at the point of contact. This may be due to the heat of the electric discharge, or to the passage of a current through the tissues of the patient, or to the fact that the shock makes the hand grasp the wire or element because of faradic stimulation, and prevents the reflex withdrawal which usually follows a painful injury. Any or all of these factors may contribute to the production of severe and deep damage, even though the area may be small Electrocution, however, may produce a more persistent and widespread spasm of the vessels, and necrosis of tissue may occur at a distance from the burn. It may be after some delay, and it is associated with a reduction of viability of the tissue underlying and surrounding it. As a result, cases which are treated by primary excision follow a somewhat unusual course At the end of a week, the graft appears to have taken well, but in the next week there is often dissolution of the graft and a breakdown of the area. It is as if the ground has been cut from under the graft when it appeared to be well established.

If a reliable history is obtainable, it may warn against the possibility of these complications, or may eliminate it. Many patients attribute their injuries to electric shock when they have suffered flash burns, or friction. If the current has actually passed through the tissues of the patient, he is well aware of it, and the information is given if he is properly questioned. He cannot, however, be expected to volunteer it, because he is not aware of its very great clinical significance.

Primary excision and skin grafting in electric burns is more hazardous than in the rest. Radical excision in the hope of getting beyond the doubtful area is a hit-and-miss procedure which may result in the removal of valuable and viable material. It is not recommended. Many surgeons delay until the necrotic area is well defined, and graft between the third and fourth week. Early removal of obviously dead and quite anaesthetic tissue with immediate skin cover is, however, a valuable procedure if it is remembered that its advantages may be only partial or temporary. One must be prepared to accept the risk of failure and to regraft any granulations or failed patches in the third week if this proves necessary.

Chemical Burns.—By the time the case attends hospital the application of antidotes is often useless. Washing with saline as soon as the burn is seen will do more good than delaying treatment until some application is sought which may not be in the department. Certain chemical burns benefit from early lavage with sodium bicarbonate or sodium thiosulphate. Organisation of works first-aid posts has resulted in an indication for this treatment *arriving with the patient* (p. 241). Casualty departments which serve industries engaged in the manufacture of chemicals should keep such solutions readily available.

Chemical burns are then treated according to the principles laid down for other burns, but two pecularities should be mentioned.

1. Staining of the surface from the nature of the chemical substance may alter the appearance and an estimate of severity may be made more difficult (Fig. 106).

2. Many chemical burns are anaesthetic from the nature of the chemical, (e.g., carbolic acid) and the pain sensitivity test may suggest a deeper lesion than is the case.



FIG. 106
Chemical burns. The appearance of fingers five days after contact with hydrofluoric acid This is an extremely painful lesion in the early stages. The middle finger required grafting. The other two epithelialised in nine days The surface of all three looked the same.

Late Burns.—Burns which have been reassessed in the clinic after the first week of treatment, or burns attending for the first time some days after the event, are unaccompanied by the diagnostic dilemmas discussed in the previous sections. If whole thickness skin damage has taken place the affected area is at this time discolored, hard, and probably beginning to separate at the edges. There is still an opportunity of carrying out a successful skin graft without septic complications, especially if the case has, up to that time, had a single dressing properly applied in the clinic. The sooner the case is grafted, once this condition is established, the better. It does not pay to wait for sloughing to complete itself naturally, for adherence is tough and the separation may take weeks. If it is intended to graft when some suppuration around the edge is already established, a delay of a day or two while waiting for a bacteriological report may be worth while. It gives an opportunity for suitable antibiotic cover to be provided. In the absence of exact information it may still be assumed that penicillin is effective. If the case is not seen until later

still, when sloughing is finished and granulations are established, the condition shows no features which distinguish it from other granulating wounds and the same principles of treatment are to be adopted (p. 130).

The Infected Burn.—If burns are seen soon after the accident and are treated in the first instance as described above, there should be no infection unless and until sloughing or granulation supervenes, and it is not necessary to prescribe the routine administration of sulphonamides or antibiotics unless evidence of infection develops. These cases, like all others, are warned to attend at any time if there is an unexpected development, and this covers the occasional incidence of a streptococcal invasion of the area. The primary excision of deep burns requires no antibiotic cover for the same reason, though it is customary to give it, and especially if pedicle flaps are used.

Burns attending somewhat later, after a delay of hours or one or two days, should have a prophylactic course of penicillin and it is believed that it reduces the incidence of septic complications.

Some cases of burns, however, attend not because of the burn, which the patients have been treating themselves, but because of superadded infection, and this may spread very rapidly when such treatments have included homely remedies applied in the kitchen. It is not uncommon for certain proprietary ointments to be used concurrently for the housewife's burn and her children's *impetigo, with not unpredictable results.*

Streptococcal infection of a burned area may be of less moment than staphylococcal or coliform infection, for it is readily controlled by rest and penicillin and it contributes nothing to local destruction at the surface. The other infections may cause tissue breakdown, and tilt the scales against rapid recovery.

All these cases, of whatever infecting organism, should be given penicillin therapy at once and the burned area put at rest, while identification of the infection is proceeding, because the chances of the organism being penicillin sensitive are high If an insensitive organism is grown, the antibiotic must be changed. No surgical intervention upon the burn should be contemplated until proper control has been established. When it has, it may be feasible to do any skin grafting which is indicated while the antibiotic level is adequate.

When excising the later cases of whole thickness burns, dissection of the tough pellicle may reveal an unsuspected pool of pus trapped in an isolated space underneath it. This is a source of dismay to the surgeon whose preparation of patient and theatre for a skin grafting operation is complete. If he mops the pus away without contaminating the rest of the wound, excises the base of the abscess chamber, and changes his instruments, he can proceed with a reasonable prospect of complete success. If he grafts on top of the granulating base of the abscess he may lose the whole graft.

Superficial Burns of the Face.—Extensive, "doubtful," or deep burns of the face should be admitted to hospital for treatment. The casualty department is not a place for excising or skin grafting facial injuries of any type.

The exposure method of treating burns consists of a careful toilet of the area, and the application of penicillin powder in lactose to it until a hard dry cake is produced. No dressings are used. It has no advantage over the methods described, in the treatment of the minor burns of a casualty department. Evaporation from the surface is adequate if cotton bandages are used, and the hard cake can be painlessly and harmlessly detached by the "cleavage" method to allow earlier return to active movements. On the face, however, it has been used for many years, and there is no doubt that in this area, treatment without any dressing gives best results. The face is carefully cleaned with a detergent, and dried. The patient is instructed to close his eyes, and hold his breath. Then he is sprayed with penicillin powder, 5 per cent. in lactose, and the treatment is repeated in an hour's time. If it is dry by then, he can return daily for observation or further treatment, or he may be required to return later in the first day, until a proper dry crust is formed. His eyelids, the rims of his nostrils, and his lips are lubricated frequently with petroleum jelly. The crust remains until it is shed naturally.

In the male, the crust is carried away by growth if the burn is in the beard area, and nothing must be done until it is lifted enough for the hair between it and the skin to be cut with scissors. No patient should shave before the skin is healed, or for three or four days after, because the surface is easily cut, and the cut is easily infected.

If it becomes apparent at any time that the severity of the burn has been underestimated, an early decision should be made to admit the case or obtain the advice of a plastic surgeon. The treatment of sloughing or granulating burns of the face in a casualty department is not advised.

Burns of the Foot.—In foundries and other heavy engineering works a common accident is for a drop or splash of molten metal to fall inside the boot, or through the vent in the front of the boot. The man cannot get his boot off quickly enough to prevent a burn on the outside or dorsum of the foot, and it *very often* involves the whole thickness of skin. Attempts on his part to obtain dressings and to return to work must be resisted. Much disability can result when these burns are inadequately treated, especially if, as is usual, they go septic. Sloughing of one or more of the tendons which lie very close to the surface is often the result of secondary infection, rather than the burn itself, and it can usually be avoided by primary excision and skin graft. Even small areas profit by this treatment, and the casualty department can do it. More extensive areas, especially if there is *involvement of* the surface of the tendons by the initial burn, usually require a pedicle graft, and must be admitted.

Burns associated with General Disease.—Epileptics are very liable to burns of all extent and severity. Pregnant women suddenly and sometimes unexpectedly subside into an eclamptic fit with similar disasters. Aged people fall against the firebars, and are too feeble to lift themselves away; or suffer strokes where similar dangers exist. Any of these underlying conditions may modify the decisions recommended for the burn itself, and particularly for the administration of anaesthesia in the casualty department; but they do not alter the principle that the best dressing for a burn is skin, and skin cover must be obtained as soon as possible.

Burns Centres.—There is a movement on foot towards the centralisation of all burns cases into special burns centres, equipped for their dressing with rooms fitted with ventilating systems, and with staff specially trained to carry out the dressings with the minimum risk of secondary infection. It is a corollary of this that the treatment will pass into the hands of a special few, and that the general surgeon and the casualty surgeon will see them no more. Segregation of burns, and special equipment are urgent needs whose provision will be welcomed by all; but the author is not alone in his misgivings about the corollary. The proper way to improve the treatment of burns is for every individual surgeon to improve his technique, and to accept the principle that secondary infection is to be minimised or avoided, in the first instance by obtaining early skin cover. It is irrational that surgeons as a whole should be denied the continuous experience of this type of injury. It is particularly irrational that such a denial is threatened at a time when the national policy is to train the population to be fitted for a defensive war. The next war will be, for the medical profession, a "burns war", and the more of us fitted to deal with burns, the better

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CHAPTER X

THE "COLD CASE"

OPERATIONS fall naturally into those that have to be done sometime, and those that have to be done sometime on the day they are first seen. This almost, if not quite, corresponds with a division into aseptic and septic—or potentially septic—cases. The septic and traumatic cases brook no delay. The remainder can await the convenience of the department.

The convenience of the department usually means that they attend a regular operating session held once or twice a week, when there is unlikely to be confusion with suppurating or contaminated cases, and when the theatre can, for this short respite, settle into the comparatively leisured and orderly routine of premeditated surgery.

Sebaceous Cysts.—Sebaceous cysts are an embarrassment not only to women, but to men who are becoming increasingly insistent that their minor blemishes should be eradicated. Many of these applications for treatment may appear irresponsible, to a casualty officer engaged on more exacting and urgent work. The maintenance of a waiting list gives him an opportunity to assess the genuineness of any alleged disability in this type of case. A waiting list of six or eight weeks results in approximately 50 per cent. of cases failing to fulfil their appointment. Many of the cysts have discharged and disappeared. Cases whose cysts are large and inconvenient, or subject to recurrent attacks of inflammation should be given priority, and dealt with promptly.

Acute inflammation in or about a sebaceous cyst may in fact demand immediate treatment. If it can be persuaded to resolve without rupture by conservative methods it should be encouraged to do so; then enucleated or excised in three or four weeks.

Simple incision into an inflamed cyst is frequently followed by recurrence, for nothing is done by this to eradicate the cyst wall and the inflammatory process has by no means necessarily destroyed the secretory cells. The surrounding inflammation prevents precise enucleation of the cyst, and attempts to do so nearly always leave some part of it behind. Under these circumstances one of two courses can be pursued. If the abscess is unruptured, penicillin cover will justify the eradication of the abscess and sharp excision of the cyst with its surrounding adherent tissue (p. 8). The operation site may be obliterated by sutures and an opportunity thus created for primary healing. This is a most satisfactory procedure when it succeeds because all the patient's troubles are swiftly overcome in one attempt.

One cannot always do this, because one cannot contemplate the excision of tissue surrounding the cyst in such areas as the face or the back of the ear. If surgical drainage is an urgent matter and excision cannot be carried out, high penicillin levels at operation give sufficient confidence for sharp curettage of the cavity, whether suppurating or not. If no attempt is made to remove the cyst, its lining can be identified and it is then carefully cauterised with pure carbolic acid. The cavity heals leaving a surprisingly small scar, and this operation gives rise to very few recurrences. These cases also, therefore, are relieved of their troubles at the first attempt, but they have a longer convalescence

The removal of uncomplicated sebaceous cysts provides no particular problem. Care should be taken if a tumour, especially of the scalp, consists, not of one sebaceous cyst, but of two close together—a big one and a little one. The latter may be overlooked and later give rise to what the patent regards as a recurrence. Operations on uninfected cysts do not need antibiotic cover. They need aseptic surgery.

Cysts on the back of the neck have frequently had repeated attacks of inflammation, are tied down to small scars from previous incisions, are multiple, and are extremely difficult to eradicate. It may be necessary to excise the whole area widely, and to be prepared to close the wound with a skin graft if so much tissue is removed that suture without tension is impossible. Outlying cysts which remain after this wide excision, especially if they occur within the hair line, may be treated individually—if infected, by incision, curettage, and carbolisation; and if uninfected, by dissection. This condition may be such an affliction that the patient will accept a radical procedure when it is explained to him that it increases his prospect of cure. This is sometimes a very haemorrhagic operation, and the patient should be detained in hospital for one or two nights in case he deteriorates in the course of the excision.

Inclusion Dermoid.—A sebaceous cyst does not occur on the volar surface of the hand or fingers, because there are no sebaceous glands there to give rise to it. Any tumour in these regions somewhat resembling it, lying closely under the skin, is probably an inclusion dermoid. It differs from a sebaceous cyst in several important respects.

It arises from cell rests in the subcutaneous tissue, deposited there by some previous traumatic breach of surface. It is therefore always associated with a scar, and may be attached to the skin by it. The scar may however be small and punctuate, and difficult or impossible to demonstrate. A prick, in fact, is a commoner cause than an extensive laceration. Because of its traumatic origin, any incapacity or loss of work through operative removal may be attributed by the patient to a previous injury, and if so, his claim to draw workman's compensation instead of sickness benefit should be supported by a suitable diagnosis on his certificate (p. 208).

It gradually increases in size, and interferes with full flexion of the fingers or hand, and it may ultimately burst through the skin, so that the skin falls away from it, with a separable undermined edge. Most cases attend before this, and show a circle of pale yellow cyst contents underneath hard cuticle, which cuticle may be grossly thickened at the limits of the circle. Removal of the cyst may leave a considerable area of the resultant cavity with no skin cover, but the skin has been pushed away more than it has been destroyed, and closure seldom calls for skin graft. Yet here again, if suture would result in undue tension, it is better to put a graft on than to risk wound breakdown. This may, therefore, be required in a few advanced cases.

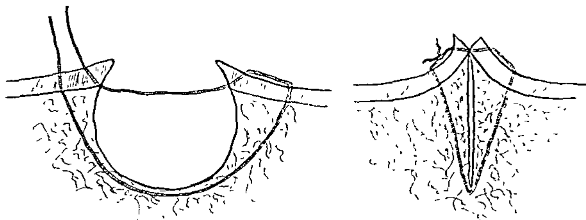


FIG. 107
Obliteration of the cavity left after cyst dissection. Excess of cuticle is cut away and one or two "vertical mattress" sutures used. The rest of the incision is sutured precisely with smaller sutures.

It should be excised with scalpel and scissors, keeping just outside the cyst wall itself. An incision carried too deeply in the initial stages of the operation may result in the evacuation of a firm shell-like tumour, well demarcated on its outside. This does not necessarily include the lining of secretory (epithelial) cells, which tends to remain attached to the surrounding fibrous tissue. To be satisfied with the production of the shell runs the risk of a recurrence. The whole lining must be removed. It does not enucleate entirely like a sebaceous cyst. It is only the contents that enucleate.

Dermoid cysts resemble sebaceous cysts in the fact that they also may be multiple, and a tumour of the hand may consist of two or three lying close together. Even the small ones should not be overlooked or left behind.

The cavity left after removal has very thick cuticle at its edges, and the stitches to close it tend to tuck the cuticle into the cavity, and thus to delay healing. The excess cuticle must be cut away before suture, and the wound closed with the "vertical mattress" stitch (Fig. 107), which is a stitch of great value in palmar wounds, and any other wounds in thick skin.

Ganglia.—In spite of much difference of opinion, and the advocacy of many different forms of treatment, there is still no known method of curing

all ganglia. It is a wise surgeon who announces that there is a definite recurrence rate—up to 30 per cent.—whatever is done, before he undertakes to treat one. If the ganglion is causing any disability, or if the patient is distressed at its appearance he (or more frequently she) will accept a two-to-one prospect of cure, and yet will not be unduly surprised or disappointed if it *comes back again.*

Operation on a ganglion is not always solely for appearance. Many patients are insistent that they give rise to pain and weakness of the wrist, and profess themselves relieved after operation. Ganglia at the base of the fingers interfere with flexion and are tender when the patient grips firmly.

Transfixion with needles, subcutaneous puncture, and the blow with a heavy weapon all have their supporters. The more methods in use for a *given purpose, the less can any one of them be relied upon.*

In many instances, if the ganglion is steadily and increasingly pressed upon, with the hand firmly resting on a table, it will be reduced, and after this reduction the patient or his relatives can repeat the treatment if it comes back Ganglia which can be kept under control by this means are best so treated Enthusiasts maintain that all ganglia can be treated successfully by it, but when it appears that a contest is imminent between the surgeon's strength and the patient's fortitude both will agree that the chances of operation are more acceptable.

Dissection should be carried out in a bloodless field so that any attachment to tendon sheath or underlying joint can be precisely displayed. If the ganglion is dissected down to this point, and it cannot be excised entire, its wall should be cut short and the communication left open. There is little advantage in ligaturing the neck. Incisions for the dissection of a ganglion at the wrist should be *transverse*, even if the ganglion lies with its long axis longitudinal. The centre should lie over the point where the deep connection is judged to be. It is of no matter where the extremity lies. Longitudinal incisions lying across a joint heal more slowly, and leave a more obvious scar, than transverse ones, even if the latter must be half as long again. Use of the tourniquet allows the surgeon to avoid section of the main veins and subcutaneous nerves. If the transverse incision is exactly closed, healing is rapid and one post-operative attendance is all that is necessary.

Ganglia recurring after this dissection are often softer, more diffuse, and more amenable to dissemination by pressure. It does not mean, therefore, that a decision to operate condemns the patient to further operations for further recurrences. Each recurrence can be judged afresh

Small, mobile, hard tumours at the base of the fingers, unattached to the skin, are often synovial cysts, with little distinction from ganglia except that they can more often be entirely enucleated. A transverse incision through the fibro-fatty pad gives good exposure, but careful retraction of the digital neurovascular bundle at one or other limit of the incision may be necessary to display the swelling fully. It is often impossible to demonstrate a deeper

connection, though it is presumed they arise from the synovial sheath of the flexor tendon or from the metacarpo-phalangeal joint. Operation on these is attended by better results and they are less prone to recurrence.

Ganglia are also to be found associated with the inter-phalangeal joints. They lie at the side of the digit, or dorsally, in which case they may follow the course of the extensor tendon (Fig. 108). Their connection is sometimes to be traced under the extensor expansion. Deliberate dissection in a bloodless field is not attended by any unusual difficulty.



FIG. 108
Ganglia may follow the course of the extensor expansion or extensor tendon This example arises close to the fifth metacarpo-phalangeal joint.

Lipomata.—A common mistake in excising lipomata is to carry out a tedious, sharp dissection just outside the limits of the tumour. If a firm dissection, or, when it is superficial, a bold incision is made well into the substance, a clear demarcation is displayed and the tumour can be enucleated with a crooked forefinger in a few seconds.

Lipomata near the shoulder joint are not uncommon, and are more frequently associated with a complaint of pain than in other situations. Their deeper connections should be determined as accurately as possible before operation. Not all are entirely subcutaneous. Some are more safely referred for In-Patient treatment than embarked upon in the casualty department.

The Painful Scar.—These cases must be approached with great caution. The relationship between painful scars and functional disorders will receive attention in its own section (p. 221). It must be realised that " minor " operations on painful scars can be the most unrewarding and embarrassing procedures which fall to the lot of the casualty surgeon. Cases referred for excision of a painful scar appear to afford an opportunity for a simple, clean, profitable operation. They may in fact do more harm than good.

There are unfortunately no hard-and-fast criteria by which the amenable cases can be separated from the unsuitable. There cannot be, when the patient with a neurotic causalgia is just as *genuine* a case, in his own way, as one

with an organic lesion, and may be cured by the auto-suggestion of an operation as easily as by any other means. Yet it must be accepted that, on the whole, operation on such cases is a failure, and it results in a transfer of the " blame " from the person referring the case to the one accepting it.

Other cases, with a definite involvement of a peripheral nerve in a scar or amputation stump, give permanently good results from a small operation, and it is unjust and unwise to refuse all cases because some are liable to bad results.

An attempt must be made, therefore, to separate one type from the other, and, though mistakes will occur, increasing experience will cause their number to dwindle, and results to improve.

The patient who gives a history extending back for some months, who complains of steadily increasing pain and tenderness, and progressive extension of the sensitive area; who presents a sweating, shiny, atrophic, trembling, blue member, whose conversation revolves interminably round his accident and his financial responsibilities, and whose final decision on compensation is still pending—should be rejected firmly, and it should be pronounced immediately that further operation is not indicated, and would do more harm than good. Occasional injustice may be caused, but surgery cannot be brought to book for the psychiatric results of modern industrial conditions; nor should a reflection on previous surgical procedures, which might be quite unjustified, be tacitly admitted by agreeing to further operation.

If, however, a complaint is brought that pressure on a certain, constant spot causes a severe, characteristic pain, referable to a definite peripheral nerve, then the picture is a different one, and it merits further surgical consideration. The spot may not necessarily be in the cutaneous scar itself, but somewhere in what may reasonably be assumed to be the previous operation field or site of injury. The pain is sudden, and short-lived. It runs up the member, or may be referred peripherally to the distribution, perhaps to " the finger that isn't there ". It is described as burning, or like an electric shock. It is unexpected at first, but the patient readily learns to anticipate it from certain accidents or with the use of certain tools in a certain way. This may be identified as due to the involvement of a cut nerve-ending in scar tissue, or to an amputation neuroma. Excision of the scar, if possible in a bloodless field, or exposure of the nerve end if it lies more proximal to the scar, will reveal the nerve fibre or nerve bundle, and it can be dissected further back, buried in healthy tissue, and cut short at a place where it will be less exposed to trauma. It should not be ligatured. If it is pulled down firmly before section the new end will retract sufficiently for the reformation of scar to be minimal.

This is a worthwhile operation, but to achieve the best results it should be carried out early, before a functional exaggeration becomes added to it. Cases which start with this clinical picture, if not cured, may merge imperceptibly into the other type, when the advantages of operation may be lost.

On the other hand, operation for tenderness in a scar should not be undertaken too early. All scars are tender for some weeks after operation, and many are prone to "rheumatic" ache, on change of the weather. This is not merely an old soldier's fable. Scar tissue from accidents and operations is sensitive to sudden changes of atmospheric pressure, in the same

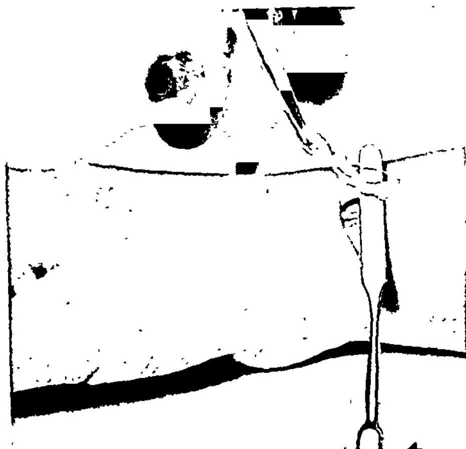


FIG. 109
This patient complained of persistent pain down the superficial branch of the radial nerve, after a lacerated wound of the forearm six weeks previously. The nerve has been partly severed, and a neuroma has formed at the upper end The neuroma was excised and end-to-end anastomosis performed.

way as scar tissue surrounding rheumatic joints. A reassurance on this point may be sufficient to resolve much anxiety, if made at the right time. If the tenderness shows signs of improvement, and is lacking the specific signs and symptoms of gross involvement of a peripheral nerve, a light protective dressing and a prompt return to work may complete the cure.

The relationship between this condition and that of a retained foreign body must be kept in mind, and signs on an X-ray film may weigh the balance in favour of operation in doubtful cases. A small fragment of metal lying on a peripheral nerve may produce the same type of pain and tenderness. If

the foreign body itself is removed the nerve may recover, and it does not require resection, unless a tumour is present.

The possibility that, once having relieved a nerve from its involvement in scar tissue, it can be rejoined to its distal end and regeneration obtained, may be borne in mind in a few cases (Fig. 109). In the majority it will be found that the nerve concerned is a very small one, and it is naturally not amenable.

Case History

A middle-aged woman attended the casualty department with a complaint of exquisite tenderness at a precise point to the lateral side of the distal interphalangeal joint. Pressure produced severe pain (" like electricity ") from this point into the lateral half of the pulp space. She reported that she had penetrated the spot with a spicule of broken glass about four weeks previously. The glass had been removed. An X-ray film showed no evidence of opaque foreign body.

The lateral part of the finger was explored in a bloodless field. The volar digital nerve was exposed, and a definite " neuroma " found involving two-thirds of the nerve at the tender spot. This was resected and end-to-end suture of the digital nerve was carried out. The patient made a rapid and complete recovery, with return of sensation in the area of distribution within six weeks.

Ingrowing Toe Nail.—The great toe gives rise to more trouble with its nail than any other, and before attempting cure of its deformities it must be decided whether they are primary, or secondary to orthopaedic conditions of the toe, the metatarsal, or the metatarso-phalangeal joint. If the deformity of the nail bed is due to abnormal pressure on the toe because of hallux valgus, the latter requires treatment and the nail can be operated on at the same time or later.

It has been accepted up to the present that curative operations such as wedge resections should not be attempted in the presence of inflammation. Any reverse of this teaching must be approached with caution, but acceptance of the principles laid down in the early part of this book will embolden the surgeon to select suitable cases—those, for instance, whose inflammation has not yet resulted in the formation of a discharging granulation—where wedge resection of the nail and nail bed, and curettage of the adjacent abscess cavity if there is one, may give primary healing and a reasonable prospect of permanent relief (Figs. 110 to 113).

If the nail bed has been discharging pus for some days before the case attends, it will be wiser to deal with it in two stages. At the first, the affected segment of nail is removed. Care is taken to carry the resection down to the base, and to remove any loose tags of cuticle in the corner of the nail sulcus. Penicillin cover is used at this stage. At the second, two or three weeks after healing, the formal wedge resection is carried out in an aseptic field.

The wedge resection of nail and nail bed is not a difficult procedure, but it cannot be emphasised too often that the resection should be carried well back. If a proximal fragment of nail bed remains it grows a painful spike



FIG. 110



FIG. 111

FIG. 110. Suppuration from an ingrowing toenail is usually regarded as an indication for a two-stage operation; firstly, removal of part of the nail and treatment of the paronychia until it is healed, then a wedge-resection after an interval. This case was treated by wedge-resection at sight under high penicillin blood-levels.

FIG. 111. Excision of part of the nail, and of the underlying nail bed, must be carried well down into the subcutaneous tissue, and well back. A deep wedge ensures that closure can be obtained, and a long one reduces the chance of a spike of nail developing from persistent cells in the corner.



FIG. 112



FIG. 113

FIG. 112. The wedge-shaped cavity is obliterated by two holding sutures and a

FIG. 113. The only ... e was a small bead of pus at the distal stitch ... was dry and healed. Cure of the sepsis and cu ... complete with one process.

through the scar a few months later, and this requires further operation. One should make quite sure which edge of the nail causes pain and tenderness before the operation begins. It is not always the side which grows in to the more pronounced degree.

Onychogryphosis.—Excessive formation of nail affects the big toe and becomes increasingly incapacitating. Avulsion of the nail gives relief for a number of months or years, and in elderly people this may be adequate treatment. It occurs in the young also, and in them, if they have already had an avulsion on a previous occasion, more radical measures may be requested. The operation usually recommended is an excision of the whole of the nail bed, amputation of the distal two-thirds of the phalanx, and suture of the plantar pulp tissue and skin to the posterior limit of the dorsal incision. The end result looks satisfactory from the side, and especially in a diagram, but unless very great care is exercised it results in a bulbous expansion of the end, which ill fits an ordinary shoe; and in any case it inevitably shortens a very important member.

If the nail bed is completely excised, the resection passes between nail bed and the periosteum of the phalanx, and if the latter is carefully preserved it will take a skin graft. This heals in ten days to a fortnight, and will withstand the wear-and-tear of a shoe and sock as well as a healed scar. The toe retains its normal width and length.

The skin graft is secured to the area by threads passed through hypodermic needles. One passes along the dorsum proximal to the grafted area. Two more are passed obliquely, one each side of the distal end of the area. Their two medial ends are joined together, and the other ends brought from more laterally and joined over the dressing (Figs. 116 and 117). The technique is exactly the same as that employed for application of a graft to a planed finger when the damage involves the nail bed (Fig. 90).

Cases have been treated by this method for the last four years, with satisfactory results. A small number of nail bed resections require re-operation for spikes of nail growing through from the base, but this is a hazard of any operation for these conditions, and depends for its avoidance on very careful excision Any failure which might occur can still be treated by the amputation operation, but such failures will be very rare if care is taken to apply a firm dressing to the graft along the lines described.

Whether amputation or skin graft is intended, certain points in the removal of the nail bed itself require careful attention, to obtain good results. The nail bed, especially where there is much deformity, extends well round the toe, and its outer extremities penetrate deeply into the fibro-fatty tissue in the lateral part of the pulp space. The proximal and lateral limits of the nail bed must be defined as accurately as possible. The disadvantages of incomplete removal have been referred to. Excessive removal of tissue proximal to the nail base will damage the extensor tendon.



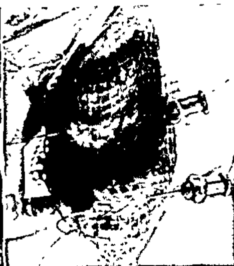


FIG. 114 FIG. 115 FIG. 116

FIG. 114. Onychogryphosis may be treated by excision of the nail bed and immediate Thiersch graft with as good a cosmetic result, and a better functional one than by removal of half [illegible]

FIG. 115. Total [illegible] the nail fold, exposing t[illegible]d lateral limits of the n[illegible] must be particularly careful.

FIG. 116. The graft is spread on to petroleum jelly gauze and applied to the site. Both graft and gauze are transfixed by hypodermic needles The proximal limit is secured by a single needle. The distal requires two needles.

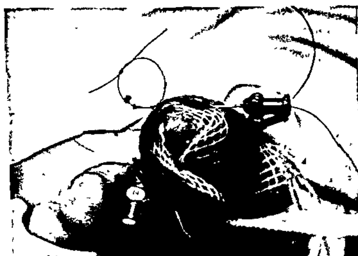



FIG. 117 FIG. 118

FIG. 117 Threads passed through the two distal needles are joined together so that when the needles are withdrawn the other ends can be tied over the dressing An even pressure is thus applied to the graft area without endangering circulation in the plantar surface of the toe No adhesive bandage is necessary. Open wove cotton bandage allows the operation site to dry at once.

FIG. 118 Seven days after operation the site is dry and epithelial growth is well advanced The cuticle will be shed and the scab separated during the next fortnight. The length and breadth of the toe are unaltered and its function unimpaired

The resection is carried out using a thin rubber tube round the base of the toe as a tourniquet. The nail fold is incised in two places, each incision passing backward and outwards away from the extensor tendon. The flap is reflected back until the base of the nail is revealed, and its lateral limits can be defined however much overlap there may be at the sulcus. The under surface of the flap which has been dissected back, the nail bed and the attached nail can then be excised in one piece. A margin is taken to ensure complete resection but excessive removal and division of the extensor tendon are avoided because the flap reflection shows the exact length and width of the nail bed. The tourniquet is released and haemostasis obtained by gauze pressure before the skin graft is applied, or before the amputation is completed (Figs. 114 to 118).

Division of the extensor tendon to the great toe is of little importance so long as a firm boot or shoe is worn, but it is a cause of accidents in the bathroom, at the swimming baths, or on the beach. If it has taken place it is obvious when the tourniquet is released, for the distal segment of the great toe drops and becomes "floppy". Attempts to suture it to the periosteum often fail and usually interfere with the application of the skin graft. If the toe is splinted at once with a plantar splint, to be retained for four or six weeks, a stable toe is usually obtained.

Subungual Exostosis.—These may prove to be the least satisfactory of nail deformities. It is not always appreciated that a bony growth is the cause of repeated attacks of inflammation under the nail, and often the patient has already suffered a number of nail avulsions before a diagnosis is made (Fig 119). Most illustrations emphasise that the growth occurs at the edge of the nail, and projects at the sulcus. Some, in fact, may be central, and a few basal, and are correspondingly less easy to detect. It can sometimes be seen raising the nail, and sometimes it punctures it and presents at the surface as a discharging, granulating ulcer, surrounded by diseased nail with underlying persistent suppuration.

Removal of as much nail as is required for a proper approach, together with any which may lie over infected nail bed, reveals the excrescence, usually with a bony base, a fibrous cap, and an infected surface. It may be removed with a sharp curette, and the base well scraped, and dressings should be continued until it is dry. This may be enough to give prolonged or even permanent relief.

If it is situated so far back that nail growth is permanently affected, the operation may have to be combined with excision of the nail bed, and in these cases healing is occasionally delayed because the graft fails over the curetted area and this has to heal by scarring. It is sometimes better with the larger growths to recommend partial amputation.

Where there is gross deformity of the phalanx, especially if the dorsum is heavily ridged, operations on the nail bed alone will not relieve the patient

from the discomfort of shoe pressure. If the ridge is cut away with bone forceps to form a flat surface a graft is unlikely to succeed. These cases also may well be advised to accept the more radical operation.



FIG. 119
Subungual exostosis. Repeated treatments at the chiropodist and an avulsion of the nail were undergone before this condition was recognised Without eradication of the exostosis treatment of the toenail itself is useless

Other Deformities of the Nail Bed.—A deformed nail as the result of sepsis or trauma may cause considerable dissatisfaction but caution is required before an opinion is given that it can be improved by further operation.

The hooked nail (Fig. 65) resulting from loss of pulp tissue and part of the distal phalanx in pulp space infections is usually best left alone. There is little that can be done for it apart from total removal, and in fact it forms a useful protection to the scarred finger and all that is necessary for it to remain harmless is intelligent manicure.

Many injuries result in loss of nail bed and pulp tissue in the distal part, but they also require no more than frequent trimming (Fig. 120).

Damage to the nail bed at operations for paronychia is not uncommon, and the main cause is wounding it by applying scissors too deeply when the nail is being cut. Removal of the lateral or medial half of the nail is the

most dangerous operation in this respect, for the scissors may be introduced beneath nail and nail bed at the distal end, and may cut the nail bed in two from one end to the other. The gap is widened and the destruction of the linear area of nail bed made permanent, by the prolonged infection which frequently follows this treatment, and thenceforth the nail grows in two parts.



FIG. 120
Loss of the distal part of the nail bed and some of the pulp tissue in a planing injury (p 133) is treated by immediate skin graft. The hooked nail which results remains a useful member and should not be eradicated. Frequent trimming with strong scissors is all that is necessary.

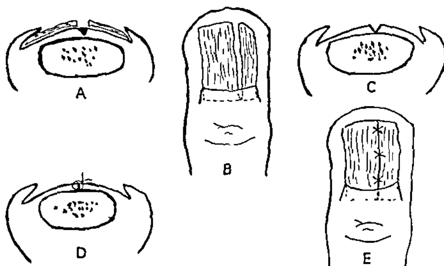


FIG. 121
Excision of a scar in the nail bed is *occasionally* successful in curing a split nail (A and B). Precise reflection of the nail fold is the first step (B). The nail is entirely removed. The scar is excised down to periosteum (C) The wedge-shaped wound is sutured (D). The proximal suture must be inserted so that the replaced nail fold does not cover it (E).

Traumatic lacerations of the nail bed also cause a permanent split in the nail if they involve the base where most of the nail genesis occurs. Once such a split is established it is difficult or even impossible to cure. An attempt to join together the two separated parts inevitably results in a reformed scar,

which of course, grows no nail, and the split, though possibly less wide, often recurs when the new nail grows through. If an attempt is made, the first stage in the operation consists of a reflection of the whole nail fold, with two incisions, in the same way as is recommended for Kanavel's operation on a paronychia (Fig. 121). This reflection, while far enough back to obtain



FIG. 122
A nail deformity resulting from injury seven years previously. The loose end caused persistent trouble and recurrent sepsis. Damage to the nail bed extended as far as the nail base.



FIG. 123
Excision of the whole nail-bearing area, with immediate skin graft, gave a good functional result without shortening the thumb.

proper exposure, must not be carried sufficiently far to damage the extensor tendon or to open the interphalangeal joint.

It is followed by an excision of the scar, and a wedge resection of the underlying tissue. Fine stitches bring the nail bed together, and the flap is allowed to return to its position without further suture. If the nail bed is wedged adequately, one or two stitches applied distally will hold it together, and it is unnecessary to suture at the base where the nail fold would lie over the most proximal stitch. This avoids difficulty when the stitches are to be removed. Such an operation is attended by occasional success, but in most

cases, especially if inconvenience rather than appearance is the cause of complaint, an eradication with skin graft is more certain.

Eradication of a finger nail and nail bed, for nail deformities which produce disability or embarrassment, can be performed in the same way as on the great toe (Figs. 122 and 123). Such a conservative operation as an alternative to terminal amputation is acceptable to most patients. The



FIG. 124
Fibroma in the nail sulcus which persisted after two attempts at removal by curettage. The loose edge of nail is due to permanent damage to the underlying nail bed.



FIG. 125
A wedge resection carried out as for an ingrowing toenail (Figs. 111 and 112) resulted in permanent cure and a sound nail.

residual mutilation is no more than after amputation, and is often less. In women the skin graft can be judiciously tinted with cosmetics to match the nails on the other fingers. Preservation of the finger pulp, and of the proper length and movement in the finger, are a justification for the extra surgical care required.

Deformities near the sulcus may be treated by wedge resection (Figs. 124 and 125).

In these cases, as in eradication of nail beds on the great toe, inadequate operations may result in regrowth of nail and necessitate further excision (Fig. 126).

One does not recommend operation on a nail merely because it has become a claw. A claw may well be a very useful feature on a hand, and preferable to an unprotected scar. Careful enquiry must be carried out on each case, to know why and how the deformity is causing trouble, before it can be decided that the finger without any nail will be better able to do its work. It is not always realised by those seeking advice that very often the only alternative to a tiresome nail is no nail at all.



FIG. 126
Incomplete eradication may result in an awkward spike growing through the graft some months later. It must be excised, together with the underlying area of nail bed.

Biopsy.—A variety of cutaneous and subcutaneous tumours may be referred to the casualty department for diagnosis, and many of them show such atypical features that the last resort is to take a piece away and submit it to the histologist for examination. The operation itself, and exposure of the tumour, are sometimes successful in making the diagnosis, and in these cases nothing is lost by excising it entire if this is practicable under the conditions. Too many cases suffer two operations when one will suffice. To establish that an axillary gland is tuberculous, by finding caseous material at biopsy, and not to proceed with a feasible, complete excision of the affected gland or glands, is to let an opportunity slip when it is within the grasp, and to prolong the patient's illness. A biopsy is no less likely to disseminate infection than a more extensive operation, and "in for a penny, in for a pound". Recent methods of dealing with dissemination of infection have very materially reduced the danger of pyaemia and septicaemia, and sufficient has been written in the first part of this book for them to receive no further discussion.

On the other hand, radical operations are to be avoided if they threaten to produce technical problems beyond the skill of the surgeon or the facilities of the department. It is advantageous, for instance, to remove a superficial group of axillary glands in the example quoted above, whereas it would be folly to embark, unprepared, upon an extensive dissection of the glands of the neck.

There is still considerable controversy on the dangers of disseminating malignant disease by carrying out biopsy when a radical dissection cannot be

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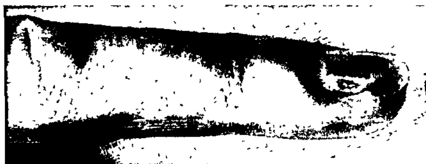


FIG. 124
Fibroma in the nail sulcus which persisted after two attempts at removal by curettage. The loose edge of nail is due to permanent damage to the underlying nail bed.

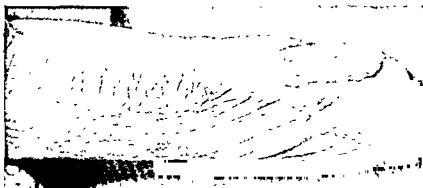


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In these cases, as in eradication of nail beds on the great toe, inadequate operations may result in regrowth of nail and necessitate further excision (Fig. 126).

promptly superimposed. Biopsies carried out on tumours which are subsequently identified as malignant still carry a grave responsibility, and where there is doubt they should not be undertaken lightly. In these, particularly, the sensitive surgeon will prefer his scalpel to pass through nothing but neighbouring tissue, rather than through the tumour itself. Entire excision, not snipping a piece away, is preferable when it can be done (Fig. 127). Perhaps the dangers have been somewhat exaggerated, for the cavity left by the excision or biopsy is usually immediately flooded with blood and lymph, so that malignant cells are more likely to be carried towards the area than away from it. Nevertheless, an excessive amount of diagnostic surgery in the casualty department is to be avoided—and if for no other reason, because it casts reflection upon one's ability as a diagnostician.

The best diagnostic ability can suffer many reverses, and although one may remain alert to the rarity, some tumours can only be diagnosed after they are removed, and others are best removed as soon as they are diagnosed, even if diagnosis is only at exploration. Confirmation of a doubtful diagnosis is identical with treatment in many examples of such conditions as the painful subcutaneous nodule ("glomus tumour")—especially when subungual—foreign body granuloma, synovioma, aneurism of the palmar arch, warty growths which may be epitheliomatous (Fig. 128), and isolated fibromata. A lipoma may occasionally defy confident identification until it has been exposed. It is impossible to define this class as its size varies with the acumen of the surgeon. In the last three years' experience of this department it has included two occasions on which the histologist himself announced his inability to make a diagnosis from the section (Fig. 84). Some of the cases which cannot be diagnosed by the clinician cannot accurately be diagnosed at all, and even biopsy, generally regarded as the last court of appeal, fails to make a decision.



FIG. 127
The diagnosis lay between epithelioma and molluscum pseudo-carcinomatosum The tumour was excised with a wide margin and an immediate skin graft took almost entirely. The diagnosis of malignant disease was established by histological examination. To carry out biopsy on a fragment is running an unnecessary increase in the risk of dissemination.



FIG. 128
Small tumours of doubtful nature should be excised entire if histological diagnosis is required. This was reported as " molluscum contagiosum "

5. In spite of anything in the foregoing which might encourage the anaesthetist to sacrifice efficiency to expediency, the casualty surgeon must make it quite clear that anaesthesia must be adequate at all stages, well under control, and capable of prolongation in safety whenever he requires it. None of the operations recommended in this book—or in any other—can be carried out properly if the surgeon is at the mercy of a struggling patient, a congested operation field, or an anaesthetist who can only give him "a minute more". Casualty anaesthesia must be good, and if it is not good, the surgical results can be no better. A precise operative technique requires something more than momentary anaesthesia combined with physical restraint, and the consolation that "he will not remember it even if he does fight". If the anaesthesia is prolonged or deepened it must be accepted that recovery may take up to half an hour, that the patient is in need of expert supervision, that he should not be allowed to go home without company, and that in any case he should not be allowed to go within an hour of operation.

Work done by the anaesthetists at Birmingham Accident Hospital has resulted in a routine there, in which anaesthesia is carried out almost, if not quite, under In-Patient conditions. Accommodation is provided so that the patients can be prepared before operation and kept under observation after it —if necessary for the rest of the day—until they are pronounced fit to return home.

It is unlikely that such a system is applicable to many hospitals, for most can spare neither the accommodation, nor the prolonged services of their anaesthetists which would be necessary. Nevertheless, all hospitals can learn from it the main conclusion; that where space for recovery from the anaesthetic is ample, neither anaesthetist nor surgeon will be deterred from continuing an anaesthetic, nor from carrying it to the depth that the operation requires, by the thought that there is no means of dealing with a deeply anaesthetised patient while the rest of the operation list is in progress. Good surgery requires good anaesthesia, and good anaesthesia requires adequate recovery accommodation. It should be adjacent to the operating theatre, so that the nurse on duty in the recovery room can obtain the advice of the anaesthetist if any complication arises (p. 202).

If recovery room space is unlimited, the choice of anaesthesia is almost equally unlimited, and no discussion is indicated. It is doubtful whether this disposes of as much as one per cent. of the casualty departments in the country.

If there is none at all, very little of the advice given in this book can be accepted, unless the intake of cases is so small and infrequent that each case can be allowed to recover in the operating room itself, before it is needed for the next.

Gas and oxygen anaesthesia, condemned by many anaesthetists as "controlled asphyxia," does not fulfil the conditions in more than a few cases. It is accused of unreported sequelae such as mental changes—which, as they

CHAPTER XI

ANAESTHESIA

VARIOUS attempts to define the ideal anaesthetic technique for Out-Patient cases have not met with general acceptance, with the result that there is still much variation in method and much difference of opinion. All are agreed, however, that there is no scope for elaborate or advanced methods of anaesthesia in the average department.

The factors concerned include the following:—

1. From the beginning of an operation to the end of it usually occupies less time than from the end of it to the beginning of the next. The change-over takes longer than the operation itself, and the change-over includes induction of the anaesthetic. One may have to take into account the time required for the sterilisation of syringes, filing tops off ampoules, finding veins, and many other minutiae which surround the anaesthetist and his apparatus. In addition, an elaborate technique materially reduces the space available for the surgeon and delays the work.

2. In the majority of hospitals facilities for looking after anaesthetic cases are limited, and it is unsatisfactory to have a large number of cases lingering while other clinics or other demands upon the staff are developing. Recovery, from the standpoint of the hospital, should be reasonably swift.

3. After effects, such as would make a return home by public transport a hazardous journey, are to be avoided as much as possible. Where they are unavoidable, return by ambulance is necessary, or the case must be detained overnight. The ambulance service, and In-Patient accommodation, are over-strained and expensive. To tax them further by routine use of certain anaesthetic techniques is not a good policy. Recovery, from the patient's standpoint, must be complete as well as swift.

4. The subsequent development of bronchopneumonia is mainly related to the sequelae of vomiting during the anaesthetic and many anaesthetic fatalities are due to the same accident. In fact, recent enquiries indicate that vomiting is the commonest single cause of death associated with or actually under anaesthesia. There is a growing belief that an accident may delay gastric emptying, and a similar inhibition may occur during pregnancy or in the diabetic. It is undesirable to administer an anaesthetic within three hours of food or drink, and this period is to be increased to four or five if possible. The importance of this must be stressed to the patient himself. He is prone to regard a meal whose size has been materially reduced by his malaise, as no meal at all.

ness—and continuation with inhalation anaesthetics may be an acceptable submission to circumstances. Recovery from this dose is usually swift and it does not attract the objections which have been raised.

A casualty department which has to maintain a rapid syringe service at the same time as a rapid instrument service for the operation list, must work nearly twice as hard. Injection anaesthesia requires almost as much assistance for the anaesthetist as for the surgeon.

Cyclopropane.—This gas is used as an additional agent for gas and oxygen, or alone with oxygen. It also has adherents, but the opinion of most anaesthetists is that it is an anaesthetic for the expert. Experts in the casualty department are rare, and this discussion is not intended for them. Vomiting under the shallow respiration of cyclopropane anaesthesia may be even more lethal than with other agents, and cardiac arrhythmia, though believed to be without danger, is a disconcerting feature of many cases. Finally, cyclopropane forms a violently explosive mixture, and this disadvantage alone is sufficient to forbid it in many operating rooms and casualty departments. Adrenalin must not be administered to a patient under the influence of cyclopropane, as there is danger of it provoking ventricular fibrillation.

Trilene.—This gives anaesthesia of a depth adequate for almost all procedures likely to be carried out in a casualty department, and can be continued for any length of time likely to be required. Any case which has had prolonged trilene anaesthesia may need a recovery period of over an hour, and is likely to complain of headache and malaise. Even after an hour or more, some cases can be dismissed only with some misgivings, and occasionally return by ambulance, or detention in the ward overnight, is indicated.

Its main advantage is that it can be used with safety, even after little experience, when gas and oxygen are proving inadequate, and it can be progressively added to the mixture to subdue a resistant case, then almost immediately reduced or withdrawn while the later stages of the operation are in progress. Its volatility is low, and its effect, once established, may be expected to persist for the few minutes usually required, without continuing its administration for the whole of that period. The average casualty operation list does not include more than one or two cases in which *prolonged* administration of trilene is necessary. In these the disadvantage of the long recovery period must be accepted.

This anaesthetic has been used in the casualty department of the Sunderland Royal Infirmary as the only reinforcement to gas and oxygen anaesthesia for the last six years. It has been available during the administration of over eight thousand cases, though not used in all of them, and there has as yet been no accident.[1] Anaesthesia has been almost exclusively in the hands of (anaesthetic) Senior House Officers or Registrars.

[1] A fatality from trilene anaesthesia in an Out-Patient has recently been reported in the lay Press

are unreported, are unlikely to be proved or disproved. A common, dangerous, and usually unsuccessful measure taken when gas and oxygen anaesthesia is proving inadequate, is to increase the proportion of gas at the expense of the oxygen. It is to be deplored. If gas and oxygen cannot maintain adequate depth without anoxia, it needs reinforcement. There is some choice in reinforcing agents, and much personal preference, but one or other must be available, to relieve the anaesthetist from attempts to continue an unsatisfactory anaesthetic by making it still more unsatisfactory.

In the choice of reinforcement there is not only personal preference, but some material divergence of views. The main reinforcing agents may be considered in further detail.

Thiopentone.—Thousands of short anaesthetics were administered during the war for operations of about the same duration and gravity as those usually carried out in casualty departments. Thiopentone was used in nearly all of them. It was equally popular with patient, anaesthetist, and surgeon. It was only natural that it should have its adherents in the post-war years. It is used by some clinics as the only anaesthetic, but by most as an inducing agent, the anaesthetic then being continued with gas and oxygen, or with gas and oxygen combined with further fractional doses of thiopentone, or combined with other reinforcing inhalations. Its advocates maintain that when it is used intelligently recovery is swift, and its continued popularity with patients is undoubted.

Most In-Patient anaesthetics are induced with thiopentone, but for Out-Patients it has certain disadvantages. The Service cases referred to were always evacuated by Service channels, so that they continued under some supervision. They were received after evacuation by medical units. They seldom if ever returned to duty within twenty-four hours of operation, and never in conditions approximating to the independent use of public transport with an untrained companion It is true that "recovery" may be swift in the sense of returning reflexes, and the ability to walk, but thiopentone has the disadvantage that many patients remain lethargic, somnolent, and of slow cerebration for twenty-four to forty-eight hours afterwards. In the opinion of many, they are not fit to be sent home within four to six hours of operation, and some would be safer if they were detained overnight.

If anaesthetic mortality is related solely to the choice of anaesthetic agent, it is found that thiopentone has the most evil reputation of all modern anaesthetics. Of all "causes", it comes next highest to the occurrence of vomiting. Many of these fatalities are probably due to overdosage, or a too-rapid build-up, and many of them might have been avoided had another anaesthetic been chosen.

In nervous patients, especially those who have experienced a variety of anaesthetics and know their relative merits from the subjective point of view, induction with 0·15 or 0·3 gm. of thiopentone—just enough for unconscious-

is of value in indicating willingness to undergo operation, and a protection to surgeon and anaesthetist against later charges of "assault" which might otherwise be laid.

Five minutes before the operation the patient is sent to empty his bladder.

Immediately before operation he removes any clothes impeding surgical access, his collar and tie, his front stud, his shoes, his spectacles and his false teeth. The heart and chest are examined.

The anaesthetic is begun with gas and oxygen (Boyle's, M'Kesson, or other recognised anaesthetic machine) and if anaesthesia is apparently adequate, the incision is made. If there is any reaction or struggle at this time, or at any other during the operation, the surgeon withdraws and awaits return to proper depth. The anaesthetist decides whether reinforcement shall or shall not be used. Undignified struggles between the anaesthetist and the patient, or the surgeon and the patient, or undignified differences between the surgeon and the anaesthetist are to be avoided—and can be avoided if it is clear that adequate anaesthesia can always be maintained, and *must* always be maintained, if the operation is to be a success.

The surgeon informs the anaesthetist of his intentions from time to time, so that the latter can judge when to withdraw the reinforcing agent, and when to withdraw all anaesthesia; as, for instance, when he does not intend to make any further incision, when his curettage is finished, when he has found a foreign body, and when he is about to put in the last stitch. Further, he will assist the anaesthetist by his operative routine so far as the conditions of the operation will allow; as, for instance, he will insert all his sutures at the same time, and tie them later—and he will complete the traumatic parts of multiple operations together, leaving such procedures as cleaning the fields, tying the stitches, and securing the dressings to the period immediately after withdrawal of the anaesthetic.

The surgeon will refrain from continuing his operation if the patient reaches too light a plane and the anaesthetist wishes to increase the depth. He will gain nothing by continuing his stimulation if the anaesthetist is in need of gentle breathing from the patient. Hasty attempts to finish the operation produce unnecessary difficulties for the anaesthetist and defeat their own object. If there is vomiting attention to it becomes paramount.

After the operation, the anaesthetist sees that there is a clear airway, the patient is a good colour, and that his cough reflex has returned. When he is satisfied on these points the patient is transferred to the recovery room, to the care of the nurse in charge there. No anaesthetised or partially anaesthetised patient can be left in a room or behind screens unattended.

No patient is allowed to go home until he announces himself confident enough to do so. None will voluntarily prolong his detention, but many will be too eager to go and should be persuaded to stay longer than they wish if they are manifestly still unsteady and ill. However urgently the accom-

Ethyl Chloride and Ether.—There is considerable and reasonable prejudice against the administration of gas and oxygen to infants and small children. Rook describes successful and safe results, but his patients are premedicated, sometimes heavily. The main objection is that minor degrees of cyanosis may give rise to spasm and jactitation. When this is corrected by temporary withdrawal of the anaesthetic the infant regains consciousness too rapidly; with all its embarrassments. Many anaesthetists prefer the open mask administration of ethyl chloride (2-5 c.c.) for rapid induction, and maintenance with open ether on a light plane until immediately before the end of the operation. If a clear airway is maintained, oxygen is not usually necessary, but it should always be available.

Premedication.—When the conditions approximate to In-Patient treatment, adequate premedication with barbiturates or narcotics is of great advantage, and contributes to a smooth induction, excellent ventilation, intubation where it is indicated, and trouble-free recovery. If it is intended to send a patient home within four hours of operation, these refinements are not recommended. One cannot safely discharge into the vicissitudes of modern life anyone who is, even to a slight degree, under the influence of drugs. It is not only against the principles of good medicine; it may be, under certain circumstances, against the Law.

These objections do not apply to the administration of atropine. It is always a possibility that a reinforcing agent will be required, and therefore atropine gr. 1/100 is given to each adult patient, forty-five minutes before operation. A suitable modification in dosage is made for children. Objection has been raised against this on the grounds that the operation may be started before the injection has had time to act. This need never be so in routine operations In the majority at least three-quarters of an hour elapses between the decision to operate and the operation itself. Many cases have penicillin injections which require a similar lapse of time before they are effective (Chapter I). Atropine and penicillin are given at the same time. In the rare event of an urgent case atropine may be given intravenously, and the anaesthetic administered within a few minutes.

Summary of Operation Routine.—When it is decided that an operation is indicated, the approximate time of operation is estimated. The patient is warned not to take anything to eat or drink until after the operation. Three-quarters of an hour before it the injection of atropine, and penicillin if also prescribed, is given intramuscularly. It is confirmed that no food has been taken within four hours, and no drink within three. It is confirmed that a companion is available who will return home with him. Written permission for the administration of an anaesthetic is obtained, either from the patient or from a responsible relative or guardian if the patient is a minor. A standard form for this is available, but many clinics prefer the signature to be on the clinical case sheet, as it is thereby less likely to become mislaid (p. 204). This

through the laryngoscope will rapidly detect the presence of any mechanical obstruction, and the alternative—to determine by direct vision that there is *no* mechanical obstruction—is equally valuable.

When the vomiting has ceased, the vomitus has been eliminated, and the colour is restored, the anaesthetic is started again. Many cases who vomit do so because they swallow much air and saliva during induction. Atropine minimises the latter. Repeated air swallowing occurs if the induction phase is difficult or prolonged. A skilful, rapid progress through the preliminary stages is the most effective preventive (second to an assurance that the stomach is empty) and many cases vomit only because their induction has taken too long, and been carried out too cautiously.

Vomiting in the recovery period seldom gives rise to anxiety, for the patient's reflexes are returning (usually rapidly after casualty anaesthesia) and his protective mechanisms are in operation.

Cardiac Arrest.—It is proposed to discuss in some detail the procedure to be adopted on the occurrence of cardiac arrest. It is repeated that there has been no case of anaesthetic collapse in the casualty department at Sunderland Royal Infirmary for the last seven years. However, the procedure may have to be adopted at any time, and any casualty officer may be faced with it. It is quite useless to wait for more experienced assistance or advice unless it happens to be in the next room—although, of course, any junior officer faced with an anaesthetic collapse should summon assistance, for he may have to show at a later date that he has done so (p. 255). If cardiac inhibition has been absolute for more than three minutes, any restoration of the heart beat can be of no more than temporary benefit. Damage to the central nervous system is by then irreversible. It should be quite clear within thirty seconds whether cardiac massage is to be considered. A time-keeper, tolling out the half-minutes, as recommended by Hamilton Bailey, is useful if there is an onlooker to spare. In the casualty department such an onlooker is rare.

If the anaesthetist gives as his opinion that the heart has stopped, the surgeon at once, if only temporarily, abandons his operation. The anaesthetist will gain considerable freedom if he can insert an endotracheal tube (the cords are relaxed, and it is easier than on some other occasions), and connect it rapidly to his anaesthetic machine. An unskilled assistant can then maintain effective aeration of the lungs by compressing the bag. Packing the pharynx is helpful but not essential. While preparations for this are in progress the surgeon is well employed carrying out artificial respiration.

A sharp blow on the precordium, or a needle put into the left ventricle, may start the rhythm, and either or both of these can be done by either the anaesthetist or surgeon. The needle is traditionally charged with adrenalin or nikethamide, and attached to a syringe. It is believed that any effect is due to the prick of the needle more than the injection. In any case, adrenalin is contraindicated if chloroform, cyclopropane, or trilene have been used.

modation or the staff may be wanted for other purposes, it is to be impressed upon all concerned that the patient must be possessed of all his faculties to the full degree before the hospital can be relieved of its responsibility. In any case of doubt in this respect an ambulance should be used. In any case where there is doubt about the patient's physical condition he should be detained in hospital for further observation.

Emergency Measures.—The surgeon is at all times entitled to voice his dissatisfaction at the depth of anaesthesia, and to require adjustment of its depth or increase of its duration—save at one, which is where the anaesthetist voices *his* dissatisfaction with the state of the patient.

Too often the inability to deal with an anaesthetic emergency is the main weakness of a casualty theatre. The anaesthetic apparatus must always be furnished with a tray ready sterilised (by the early morning routine) containing syringe and needles, an ampoule of nikethamide, and one or more of any other suitable or recognised antidotes which may be valuable for the type of anaesthetic in use. It is also considered by many anaesthetists that suction apparatus, entirely devoted to their own use, should be available; and if so, it should be.

It is a routine that the anaesthetic apparatus should include mouth gag, tongue forceps, and airways. It is perhaps not quite so universal, though of great value on occasion, to add to these, as standard equipment, laryngoscope and endotracheal tube, Magill's forceps, and a piece of gauze of substantial length—three or four yards. The latter is used for soaking up regurgitations, and if a single large piece is provided, it can be used on the " roller-towel " principle without danger of loss. If many smaller pieces are used the danger is present.

Familiarity with the larnygoscope and endotracheal tube is required of casualty anaesthetists, not so much for their use in routine anaesthesia, for there is seldom any call for it, as for their value in emergency.

Vomiting during induction, or during the course of an anaesthetic which may have become too light, is the commonest mishap in casualty anaesthesia, and because of its association with post-anaesthetic complications and with many of the fatalities attributable to an anaesthetic, its occurrence, or the threat of it, demands instant and pre-eminent attention.

The anaesthetic must be stopped and the facepiece removed. The operation must usually be stopped also, and the operation field, if necessary, covered with a sterile towel until the patient is quiet again. Any disturbance of instruments as, for instance, when the neck, ear, or face is the object of operation, must be accepted The head is turned to one side, and a gag inserted. The top of the table is lowered, or the foot raised. Regurgitated material which has accumulated in the pharynx may have to be mopped out, unless the patient is light enough to cough or spit it out himself. If laryngeal spasm is associated with the vomiting, and persists, inspection of the cords

long scissors have been demanded. In the last resort, the ligament can be slit with a knife, but it should be held between the fingers to avoid cutting large veins which sometimes occur towards its right extremity.

At any stage in the operation, evidence that the heart is beating, such as arterial bleeding, or observation of a heart beat through the diaphragm, calls for a halt, but not for a retreat, until the anaesthetist is satisfied. If there is still no sign of activity, the surgeon may give a preliminary dig at the apex of the heart, through the diaphragm, and occasionally this is effective in starting the beat, but this, and attempts to " massage " the heart by squeezing the ventricle between the right hand under the diaphragm and the left pressing upon the precordium from outside, are half-hearted measures. They are not to be continued for more than a very few seconds. If there is no response by this time (it is somewhere between the minute and a minute and a half) the pericardium must be opened through the diaphragm, and the sooner the better.

The tendinous part is incised by the point of the scalpel, the blade directed toward the surgeon, and the incision is continued until the hand can be introduced, and can grasp the ventricle firmly. The heart is then gently and rhythmically compressed, about once a second, and this is continued until it is felt to leap inside the hand—or for twenty minutes.

When there is a response, the surgeon will keep his hand in position, and allow the heart to beat spontaneously, until a regular strong rhythm is reasserted. He will start it again if it falters. When the rhythm is well and firmly re-established, he will withdraw, but he will not close until the anaesthetist is satisfied. He properly replaces the left lobe of the liver without fixation, if it has been displaced, and he sutures nothing but the abdominal incision. The original operation is considered by both anaesthetist and surgeon, and a decision is made to abandon, curtail, or complete it. The surgeon arranges to admit the patient for In-Patient observation, and makes a report in duplicate, one copy for the In-Patient records, the other for himself.

If the combined efforts of anaesthetist and surgeon are of no avail the remainder of the procedure is a medico-legal one, and is discussed with certain similar responsibilities in a later chapter (p. 255).

The Chronic Bronchitic.—Chronic bronchitis, as long as it is unassociated with congestive heart failure, is not usually a contra-indication to Out-Patient anaesthesia, though it gives rise to difficulties in administration. Pyrexia from an acute exacerbation is an indication for postponing operation if it is possible or, if not, for admission to hospital.

Chronic Heart Disease.—The patients who collapse on the operating table from cardiac failure are almost always unsuspected of previous heart disease, and almost always suffering from coronary insufficiency. Provided aeration

As has been said, the next stage must come quickly if it is to be any use at all. There is never more than about sixty seconds for the preparation for it, and even in the best organised departments there is a tendency to confusion, and occasionally perhaps amongst the junior staff, to panic. Let the instructions be simple and clear. To perform cardiac massage the surgeon needs

1. Access to the epigastrium and precordium (essential).
2. An antiseptic (not essential).
3. A pair of sterile gloves (not essential).
4. A sterile scalpel (the scalpel is essential, the sterility is not).

The next instrument which may be needed is a pair of long scissors. Once the above have been provided the scissors are sought. They should be sterile if possible. Further efforts produce two pairs of artery forceps for lifting the peritoneum, if there is time.

Such an abandonment of surgical ritual is a ruthless measure. Nevertheless, much discussion, misunderstanding, and confusion may ensue, while nurses apply their previous training to a situation which demands that they modify it. Precious minutes go by with nothing to show for them. An aseptic operation five minutes after the emergency is of no value at all. An operation of doubtful sterility within sixty seconds may be life saving.

The completely collapsed appearance of the patient, with waxy pallor, fallen jaw, atonic body, and dilated fixed pupils adds urgency to the situation. A return of pupil reactions and evidence of capillary circulation, especially flushing of the lobe of the ear on release of superficial pressure, may indicate a tendency to recovery, but the only reliable physical sign, and the only indication to withhold drastic measures, is observation or auscultation of the heart beat, or palpation of the pulse.

The anaesthetist gives or withholds the word. If he refrains, more acceptable arrangements are made. He takes over artificial respiration, the surgeon scrubs up properly, and the instruments are replaced with others beyond reproach, and in greater variety. The surgeon remains ready to massage the heart until the anaesthetist is satisfied that the patient is out of danger. He will then confer with his colleague before making a decision on the original operation, and the crisis is over.

If he gives the word, the surgeon makes an upper midline incision from alongside the xiphisternum to the umbilicus, down to the rectus sheath, and through it. He cuts through the peritoneum as circumspectly as possible (he may have nothing to hold it up) starting immediately below the xiphisternum, so that if he damages anything underneath, it is likely to be a superficial part of the liver. He lifts up the subcostal angle with his left hand, and looks upwards to the diaphragm.

It may be necessary in rare cases, to reflect the left lobe of the liver to obtain access, by section of the left triangular ligament, and this is why the

reduces viability, spreads infection, and may militate against a proper reaction either to trauma or to infection. Regional anaesthesia requires considerable skill and experience. This is obtained at the cost of some suffering on the part of the patients involved in the earlier stages. When a casualty department changes its surgeon every six months, the percentage of patients skilfully, painlessly, and satisfactorily anaesthetised by regional infiltration is not very high.

2. The infiltration of peripheral nerves, and the administration of " ring block " anaesthesia, require a faultless standard of asepsis. A return in an operating list to the aseptic infiltration of late cases, after operation on early septic ones, has obvious dangers.

3. The inadvertent or deliberate combination of adrenalin with local anaesthetic in digital block administration may lead to extensive skin sloughing, or even gangrene of the finger. It is suspected that a significant number of unreported cases of amputation occur each year from this misadventure.

4. The tendency to operate too soon after regional infiltration is difficult to resist. Twenty minutes should elapse. If anaesthesia is incomplete, further infiltration should be succeeded by another twenty minutes. If an " assembly line " system can be used, or if a suitable number of cases can be anaesthetised in series, then operated upon in the same series, no loss of time will occur. Casualty departments, however well organised, can seldom work to such a rigid system as this, at least in the daily acute list.

This disadvantage does not apply to the use of " Xylocaine ", which establishes anaesthesia more rapidly than other drugs. It may be that this anaesthetic will increase the popularity of local anaesthetic as a whole, and that its advantages, under certain circumstances, may outweigh its disadvantages. The safety of " Xylocaine," however, is not yet definitely established, and some cases of serious toxic reactions have been reported.

5. Brachial block anaesthesia is used in many clinics to allow operation on the arm of " poor risk " patients, and wrist block for operations on the hand. It may be a useful measure in saving hospital beds and reducing the personal inconvenience of the accident. (Patients will prefer to get home again to their affairs if other things are equal.) Occasional pneumothorax, or permanent damage to the nerves (especially if infection supervenes) must be offset against these advantages and, although the technique is standardised and well described, it should be undertaken only with experienced assistance.

On the other hand, most of the conditions discussed in Chapter X (the " cold cases ") are suitable for local anaesthesia. Sebaceous cysts, lipomata, ganglia, inclusion dermoids, and similar conditions can be infiltrated intradermally and subcutaneously. They are treated " by arrangement ", the list is almost if not entirely an aseptic one, two or three cases can be anaesthetised

is well maintained, and the anaesthetic contains an adequate proportion of oxygen, provided also that thiopentone is never used (for it is absolutely contra-indicated in Out-Patients with cardiac insufficiency) it is unlikely that fully compensated valvular disease materially increases the anaesthetic risk. Nevertheless, the casualty department is particularly liable to attract adverse criticism if untoward occurrences come to the notice of the Coroner or of the Press. Any known cardiac case, any patient in whom gross cardiac disease is detected at examination, or anyone in whom a history suspicious of angina pectoris is elicited, should be admitted to hospital for even a minor anaesthetic. It is doubtful if the risks are thereby significantly diminished, but every precaution must be taken, and In-Patient treatment is accepted as one of them.

Other "Bad Risk" Cases.—Many "bad risk" cases requiring minor operations under general anaesthesia will be admitted to hospital for them because of associated general conditions—such as uncontrolled diabetes, uncontrolled epilepsy, or arterial disease. Other cases with similar conditions will be denied operation because it is not regarded as essential. (Many of the secondary operations in this book are not essential, and would not be contemplated under these circumstances.) Some septic conditions in such patients are more wisely treated if their inflammation is controlled by immobility and penicillin while the pus is allowed to point at the surface and discharge spontaneously, accepting the more prolonged convalescence rather than the dangers of anaesthesia.

Others, though difficult to diagnose according to textbook principles, may suggest circumspection merely from their appearance. They may not be fibrillating, may not be anaemic, may not be hyperpiesic, may not conform to any other medical state—but they look *feeble*, and this alone is an adequate deterrent from sending them home after a successful anaesthetic, or contemplating the possibility of an unsuccessful one. Many patients in their eighth decade tolerate general anaesthesia well, and can return home soon afterwards none the worse. Others give rise to misgivings, and they should be accommodated, for at least one night after the operation.

Local Anaesthetic.—A *preference* for local anaesthesia holds sway in many clinics, and there is a tendency for the preference to extend its influence. It is maintained by the enthusiasts that local anaesthesia is more effective, is tolerated well by patients, and avoids the operative and post-operative disadvantages of a general anaesthetic which have been considered in detail in the foregoing part of this chapter. With the possible exception of the first these arguments may be accepted.

The disadvantages of local anaesthesia are—

1. In many cases, and in all septic cases, regional anaesthesia will be necessary. The operation field must not be infiltrated, for mechanical distension and introduction of foreign chemical substances into the tissues

CHAPTER XII

ORGANISATION

CASUALTY officers are appointed to a "going concern". Their first days in the department are spent in accepting a routine of work which has been in operation for some time—sometimes for many years. It has developed by an *ad hoc* process and there is no rationale underlying much of it. This is regarded by those who dislike excessive organisation as a virtue. It is regarded by others as the ideal because it is well established and they are used to it. Any alterations which the medical officer proposes to introduce are liable to arouse opposition from the passive and the conservative. He must often tread warily, with great tact.

This is a place where many things progress of their own inertia. Its loyalty may be given to one local application in preference to all others for reasons which would not bear controlled investigation. Much of its established usage is based on personal preference, and much of it is traditional. The rest may be at the dictate of passing fashion. The shelves and cupboards often reflect the persuasions of the most recently departed representative of the drug houses.

The casualty officer will do well if, in his mind, he questions every one of the accepted processes from time to time, and enquires whether they have a rational basis or a traditional one. It would be impossible to carry out controlled investigations into every query which would arise, and chaos would result if more than a minute fraction of his questions were put to the test. Every officer can, however, investigate a few, and the sum total of such investigations would be valuable.

Local Applications.—The impact of chemotherapy and antibiotics on the surgery of minor conditions has shifted the emphasis away from local applications. Other works on minor surgery indulge the preferences of the authors for this or that antiseptic, and one's own preferences have been indicated from time to time; but an argument against reliance on any and all of them has already been advanced (p. 2). If it is accepted in any particular case that a local antiseptic is unnecessary, its application causes extra and unprofitable labour, and wastes time. It may, indeed, if it calls for an extra dressing, give rise to an extra occasion on which secondary infection may occur.

If a lacerated wound is mechanically cleaned, and exactly closed, the application of an "antiseptic" dressing is unlikely to add any safeguard. It cannot penetrate the wound, because the surface has been reconstituted. It cannot maintain sterility of the surrounding surface for long, because experiments show that the skin becomes reinfected with its own exudations within

at the same time, and the advantages of local over general anaesthetic are well displayed. Above all, the surgeon may rely on a leisured approach to the operation, for he has presumably arranged it at a time when he can hope for freedom from interruption.

In this type of case, general anaesthesia need only be contemplated where the patient volunteers a preference for it. Many prefer to be "put to sleep", and if they say so, it is probable that they will prove uncooperative and nervous under local infiltration.

Local anaesthetic may also be chosen, when the "pros and cons" are about equal, where a minor is to be operated upon, and parental permission is difficult to obtain (though small children are usually unsuitable subjects and cooperate badly) or where the services of an anaesthetist are available only after such delay as would harm the patient, or where his services are not available at all.

Many surgeons prefer, especially in septic cases, to admit a case to hospital for general anaesthetic rather than to attempt an operation with local anaesthesia under unsatisfactory conditions.

The crux of the controversy regarding most cases lies in the quality of general anaesthesia available The advocates of local anaesthesia preface their arguments by pointing out that general anaesthesia is usually inadequate. This need not be so. If general anaesthesia is good, the expedition of a list carried out under it is of very great importance to a busy department. If it is good and safe, most objections to it are removed. It must be agreed that, speaking generally, those clinics which have advocated and practiced local anaesthesia have plenty of time, plenty of skilled assistance, and (especially on the Continent) are often those in which the standard of general anaesthesia has not been well maintained. The solution lies, not in abandoning general anaesthesia, but in improving it. An improvement in standard in casualty departments will be a very great step forward in the improvement of the surgical services as a whole.

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to soak them off and allow the patient slowly to unwind the bandage and pick the dressing to pieces. The disadvantage of this, apart from the time and space taken up by the patient, has already been pointed out (p. 150). If the bandage is kept dry, the best line of cleavage is at the skin surface itself, unless the original dressing has been of two layers of petroleum jelly gauze, when the line is between them (p. 151, " cleavage dressings "). Nearly all bandaged dressings have some part, usually on the opposite side from the lesion, where they can be cut down to the skin. Frequently the patient is the best judge of where this is. The whole dressing can be " bivalved " and shelled off the wound in one piece. Stitch ends entangled in the dressing are supported *seriatim* with forceps while the gauze is detached from them.

If pus accumulates under a dry gauze dressing, the latter may act as an obstruction until it is removed. Obstruction causes tension and a return of inflammatory—throbbing—pain. Each patient is instructed to attend at any time if there is an increase in pain, and if he does so the wound must be inspected. Removal of the dressing evacuates the pus, and the cavity can be gently cleaned out with dry gauze held in forceps and a fresh dressing applied. A drop of chloramphenicol in propylene glycol (5 per cent.) may be of some service to sterilise the superficial surface of the cavity for a short period. It is effective against most staphylococci, whether they are sensitive to penicillin or not, and the incidence of penicillin resistant staphylococci in *persistent* wounds is increasing much more rapidly than the incidence of chloramphenicol resistance (p. 49). The local application of other antibiotics, and of sulphonamides, may cause a local or general sensitisation (p. 76).

The use of small pieces of dry sterile gauze, as the routine dressing for all types of wound, has greatly reduced the labour of a casualty department. The principle of leaving such dressings undisturbed for periods of three, four or five days has the same effect. Both principles give better clinical results, for the time when a wound is most likely to become secondarily infected is when it is redressed, and when it is wet. Reducing the frequency of attendances and abolishing wet dressings have minimised the risk. The interests of the patient and the relief to the hospital staff correspond exactly in this matter.

Petroleum Jelly Gauze.—Examples have already been given of occasions when petroleum jelly gauze is recommended as a dressing, and in particular its advantages in the treatment of burns have been instanced. There are other opportunities for using the " cleavage " method which will occur in the daily routine. On other occasions petroleum jelly gauze is perhaps used too frequently, because the comparative painlessness of removing a dry dressing when it is done skilfully is insufficiently appreciated. The main disadvantage of petroleum jelly gauze is its liability to dam back discharges and post-operative exudations, which results in a spread along the surface of the skin, macerating it and provoking eczematous reactions, multiplying organisms and infecting adjacent hair follicles.

an hour of sterilisation. Dependence is placed instead on other factors for avoiding infection of the wound—on keeping it dry, on allowing it to use its natural powers of resistance to obtain first intention healing, and in some instances on reinforcing or temporarily replacing these powers with parenteral antibiotics.

In granulating wounds local applications are used during the few days when the granulation is being prepared for skin grafting, but the disadvantages of too much reliance on them have been emphasised, as has the danger of allowing granulations to persist unhealed. Sterile saline, chloramphenicol, and certain proprietary preparations with a local effect on infecting organisms play a part, but it is only a small part, and cannot replace surgical measures to accelerate healing.

The "eusol" dressings, hydrogen peroxide baths, proflavine gauzes, magnesium sulphate and glycerin pastes, tannic acid jellies, and many others are disappearing. Even kaolin poultices hold their popularity more because of the heat they carry with them and because of faith in the comfort they bring, than from any scientific justification which can be advanced in their favour. The heat itself is said by some to be unnecessary.

The Dry Dressing.—If an aseptic operation cannot rely on its asepsis, putting an antiseptic on to the top of it will not save it from breakdown. The wound should be covered with a dry dressing and left undisturbed until it is healed. After five or six days the dressing is peeled off, and it carries any exuded and dried blood with it without discomfort to the patient. Discomfort may be caused by stitches catching in the meshes of the gauze and these should be eased away from it with a pair of forceps, as the dressing is removed.

Where a septic condition has been treated by surgical eradication under the protection of an antibiotic it is hoped that a sterile wound will result. It is dressed with sterile dry gauze and left undisturbed for four or five days. The gauze is peeled off at the end of this period and dried blood is carried away with it. This also proves to be a painless process and frequently the underlying wound is dry at this attendance, or when a second sterile dry gauze dressing is removed on the seventh or eighth day. Sometimes a haematoma must be evacuated at the first post-operative attendance (p. 7) and the wound will be dry at the second or third.

If an open wound is clean but not healed, it is not necessary to establish this fact by pulling the whole dressing off. The edge of the gauze is lifted and one extremity of the wound is inspected. The gauze may then be replaced and rebandaged without provoking haemorrhage. This is repeated at succeeding attendances until peeling it away reveals a dry epithelialised surface (p. 118).

Dressings applied immediately after an injury or operation often become incorporated with wool and bandage in an inextricable mass. One is tempted

Under ordinary circumstances no member of the dressing team is "scrubbed" up. Everyone uses clean, dry hands. Any accidental contamination with discharges calls for a wash and dry on a clean, not sterile towel. Making no attempt at hand sterility avoids any misconception that dripping fingers fresh from the wash-basin may be innocuous.

No lesion is touched by the fingers. No part of a dressing intended to contact a lesion is touched by the fingers, or by that part of an instrument which has touched the fingers. Once the dressing gauze is applied, however, it may be held in position or adjusted by clean hands, for its outer surface is destined soon to contact a clean but not sterile bandage.

A dresser, nurse, or porter acts as usher. His function is to marshall the patients in suitable order, to cut bandages and other covers—but not to remove them—to render splints easily removable, to make lesions accessible, to produce X-rays and bacteriological reports at the same time as the patients, and to see that the casualty officer has a steady flow of cases. These functions should not be performed by the casualty officer himself. They take as long as the consultations.

The casualty officer removes the actual dressings himself. If a dressing has accidentally come away with the cover, the usher sees that a sterile cover is supplied while the patient is waiting. No wound is left exposed. The casualty officer is provided with a receiver in which sterile plain dissecting forceps rest, their handles projecting beyond the rim. He has another receiver containing pieces of folded sterile gauze. If he favours a local application it is provided in a drop bottle. He uses gauze held in the forceps for wiping away discharge and cleaning abscess cavities. The forceps extract slough and hold cuticle. Another receiver may contain scissors for cutting away adherent matter or for removing stitches. Once picked up the instruments are used on the wound until the dressing is complete. Once picked up, the handles are unsterile, but the other ends are kept uncontaminated. Instruments are never returned to the receivers. Pieces of dry gauze are extracted from the pile with the forceps without contaminating the rest. The dressing is held in position by the patient while he moves to another booth for a nurse to apply wool and bandage. The instruments used are discarded and cleared away (Fig. 129).

By far the majority of dressings can be performed by this "no-touch" technique without the necessity for frequent hand washing. It is quicker to sterilise and serve twelve pairs of dissecting forceps than to wash and dry the hands twelve times. It is also safer.

An usher, a doctor, and a nurse can deal in this way with thirty to forty cases in an hour. A constant watch is kept for "bottle-necks" and a second nurse is detailed to deal with cases which threaten to hold up the line. These cases are commonly those needing splintage, the more elaborate burns dressings, strapping applications to sprains, "viscopaste" to leg wounds, plaster of Paris casts, and the removal of stitches from complicated lacerations.

Proprietary preparations of petroleum jelly gauze are offered in a tin filled with petroleum jelly, and when a piece of gauze is removed from the tin and applied direct it carries so much with it that it is frequently equivalent to a thick inunction. It acts as an occlusive dressing. Excess should be removed by rubbing between pieces of dry gauze, until the interstices are clear and the mesh is properly displayed. If this is done opportunity is given for exudations to pass through into the overlying gauze and wool, and the ill effects of occlusion are avoided.

Even when the gauze is well rubbed out, the imposition of one layer over another is liable to cover the interstices and produce the same untoward result. This must be carefully avoided when a double layer is used. More than one layer should not be used unless there is the special intention of using a " cleavage " dressing, and then they must be applied accurately one over the other. More than one layer is unnecessary, for instance, on skin grafts. A piece of petroleum jelly gauze wrapped round and round a wound of the finger or hand shows that the dresser's object has been to cover it up rather than to assist it to get well.

Petroleum jelly gauze dressings should not be kept on granulating surfaces for long periods because granulations grow through the mesh and proliferate on the other side. When the gauze is finally removed the granulating buttons are torn away and bleeding and reinfection result. The fault is, of course, unlikely to be committed in a department which will not tolerate long periods of granulation however they may be dressed.

The Dressing Queue.—The day's routine begins with a number of patients making their second or succeeding attendances for dressings. Organisation of this clinic so that all cases are dealt with expeditiously and efficiently allows time to consider and deal with new cases later in the morning. Full use should be made of the staff and accommodation available. The staff should clearly *understand the measures which are taken to avoid cross infection.*

If accommodation were ample, and patients few enough, there is no doubt that a full aseptic ritual for each dressing would be ideal; but such conditions are so rare that they merit no further consideration. Concessions have to be made, but they need be fewer than is generally supposed, even with a small staff.

Reference has been made to the " assembly line " system of dealing with wounds and dressings, which very materially raises the standard of asepsis (p. 110). It is suitable for adoption in the large clinics where a number of dressers and nurses is available. Where the casualty officer is the only medical man, and two or three nurses or orderlies represent the limit of the assistance available, a modified system can be adopted, and the following is recommended. It is based on certain principles put forward in a Medical Research Council report on cross-infection issued ten years ago. These principles have withstood the test of time.

If a special corner, cubicle, or anteroom can be set aside for this purpose it is valuable. Such a recess can be devoted at other times to procedures requiring asepsis without general anaesthesia. It is used for injections, removal of stitches from elaborate wounds and many of the procedures detailed to the "free-lance" nurse. The theatre can be used for this if no alternative accommodation is available, but such a dual purpose for operating theatres is to be avoided if possible. Some provision must be made, either by these or other means, for accommodating those cases which would otherwise cause a hold-up at the bandage booth.

The medical officer stitches all wounds requiring anaesthesia.

All unnecessary attendances should be avoided. A marked reduction in the frequency of dressings has taken place since it has been realised that repeated applications of antiseptics and repeated removal of dressings may do more harm than good. When a patient is told to attend again in four or five days, it must be impressed upon him that he must attend at any time earlier than this if his progress is unsatisfactory. In this way complications which may arise (and especially the onset of sepsis) can be detected and dealt with. It is wasteful of everyone's time if he is required to attend frequently merely to report that he is comfortable.

Some injections of antibiotics can be made without medical consultation. The routine post-operative penicillin required in many of the cases described is given by a nurse, and it is unnecessary for the patient to wait in a queue to see the doctor beforehand. Other cases such as those undergoing a "course" of penicillin injections for erysipeloid, can make similar arrangements for two or three days while the casualty officer assesses progress twice a week. These attendances should be made at a time when the doctor is available, in case the patient reports dissatisfaction with his condition.

On the other hand, septic lesions which one hopes will be aborted by conservative treatment cannot be delegated to a nurse, and should be seen daily.

Many of the points made in this section may appear to over-emphasise the obvious, yet it is remarkable how often unnecessary work is shouldered, unnecessary travelling by patients is demanded and unnecessary delay in attention is accepted, for lack of a little organisation. One would deplore elaborate "time and motion" studies, or too rigid application of business efficiency methods to medical work. Nevertheless, it is to be remembered that the work of a casualty department, more than of any other, consists of carrying out a very large number of processes each of which takes a comparatively short time. Everything unnecessary must be cut out. The necessary work must move at a steady rate. Patients capable of it must move themselves from stage to stage of their attention. Members of the staff must not move about from patient to patient more than is absolutely necessary. These are the foundations of an efficient system.

She may also be required for those which call for privacy, and as occasion demands she prepares such cases and the casualty officer deals with them in a similar manner to those he sees at his desk. It is essential to have at least one "free-lance" nurse to whom such cases can be diverted in order to maintain an even flow. It is advantageous to have two. If there is one doctor to three nursing assistants only one quarter of the patient's attention is provided by him. That quarter is devoted to essentials.



FIG. 129
Plain dissecting forceps, scissors, dry gauze, and a drop bottle are sufficient to dress the majority of wounds. By using "no-touch" technique, in so far as the dressing is concerned (but not the bandage), *the surgeon can alternate between dressings and note-taking, and* between aseptic and septic cases, without moving from his table

Such a system allows attention to septic and clean cases without interruption. There is no danger of transferring infection from one case to another if every instrument, every dressing, and every drop of application, once taken from the stockpiles, is either carried away with the patient for whom it is intended, or discarded. It also allows dressings to be done, notes to be made, letters to be written, and so on, in the same uninterrupted way.

Most suturing can be done by the senior nursing staff, or the junior staff under instruction. A trained nurse is at least as efficient and accurate in this as a medical man. The wounds on first arrival are seen and assessed by the casualty officer. They are covered with sterile gauze and referred to the nurse, who washes and dries her hands. She gently cleans the wound with pledgets of wool soaked in detergent, and held in forceps, then dries it and her fingers (if they got wet) with sterile gauze. Fine needles held in needle holders, and fine forceps allow repair without contaminating the wound with the fingers. This is much safer than to use wet hands with drops running down the instruments into the wound. To don sterile gloves for each case is impracticable.

supply of those most needed. The supply of these is meagre *because* they are most needed, and therefore most frequently at repair.

The theatre work should not be held up for want of plenty of instruments. If the average number of cases is six, then six sets of instruments should be available. Six cases take from three-quarters of an hour to an hour. Each

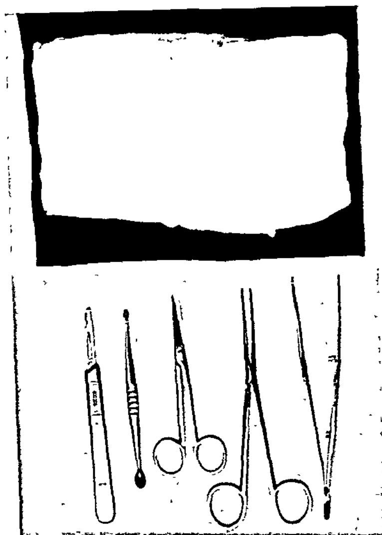


FIG. 130
Over-elaborate preparation for minor operations wastes energies This equipment is usually adequate for operation on the septic hand, or on other subcutaneous abscesses. (The dissecting forceps are without teeth.)

case should have its own " set " in its own container. The " sets " are all sterilised together before the list begins. Only if the list exceeds six cases need sterilising be carried out while operations are in progress.

Very few instruments are needed for the commoner type of operation. One container has a Bard Parker scalpel (septic hands are best incised with a No. 15—septum—blade; to attack a small finger with a large knife is an

Special Dressings.—The routines so far described are applicable to the majority of cases, those which are running a normal course, are healing rapidly, and whose sepsis, if there is any, is under control. One may hope that all cases come into this class, but in all departments, however successfully run, there will be one or two cases attending where tedious dressings of secondarily infected wounds must be undertaken, and where special efforts are indicated. Such cases include those requiring preparation for second intention skin grafting, cases where a skin graft has failed to take, and cases where an ischaemic necrosis of a flap of skin has supervened. They call for a strict routine and proper surgical ritual, not only to protect them from acquiring other infecting organisms which complicate the picture, but to prevent their infection spreading to other cases.

Again, a room set aside for these cases, if it is possible, is the ideal Whether a room can be spared for them or not— a *routine* must be set aside. They should not be taken through the mainstream of the department. They should have a separate dressing tray put up for each case. Gloves should be worn with proper aseptic precautions. At any one time there should be very few of them, and to demand this individual attention is not unreasonable. Each case should attend by appointment. This will avoid taking a nurse away from other routine duties from which she can ill be spared. She is less likely to be hurried. The patient is less likely to be kept waiting. The best time is at the end of the routine dressing queue, unless there is enough staff available to man the dressing queue, the " clean room," and the " septic room " all together. No nurse should perform the double rôle of attending to these cases and other routine cases at the same time. Ten years ago the casualty department was a place where septic wounds were the rule rather than the exception. Now the opposite holds true. The long-standing septic wound must be isolated from the rest, while measures are being taken to deal with it. Those measures are based on the conception that these are the cases which profit by particular attention. Clean wounds can be relied upon to get better Dirty ones need extra treatment.

The Operating List.—A variable number of cases which require operation accumulate in the course of the day. Organisation of the theatre, as of all other parts of the department, must vary with the conditions, but under all conditions it is profitable to allow a number of cases to collect before the list is begun. Three-quarters of an hour before it atropine and penicillin injections, sterilisation of instruments, and other preparations get under way (Chapter XI).

Many theatres have a " pool " of sterilised instruments from which some are extracted for each operation, used, resterilised, and returned to the " pool." Sterilising periods tend to become curtailed when the theatre is busy, and the last addition to the " pool " tends to become the first to be extracted. Very often there is an ample supply of instruments infrequently used, and a meagre

A container for skin grafting has a scalpel with two or three No. 22 blades, two pairs of plain dissecting forceps, and two or three hypodermic needles with nylon threads known to pass through them. The straight skin

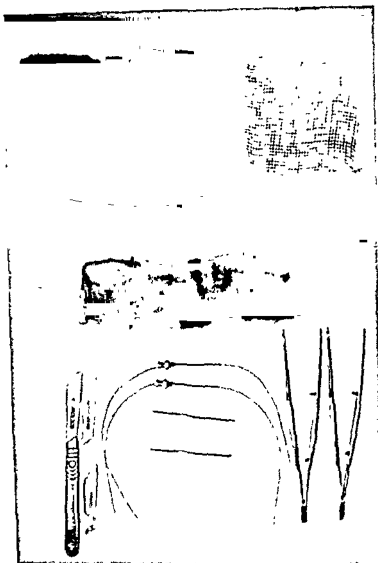


FIG. 132

Skin grafting procedures in minor surgery should be simple. Skin graft knives require more careful cutlery than a casualty department can offer. Most Bard Parker blades will cut a thin graft (Fig 91), but spares should be available. The graft should be fixed to the area with nylon thread so that a porous bandage can be used instead of a non-permeable one. (Both these pairs of forceps are without teeth.)

needles illustrated are of great value in manipulating small patches of skin. Either the blunt or sharp end is used according to need. The eye may be used to guide a needle or stitch through the skin, graft, and overlying gauze (p. 137). Their size is a convenient one for handling (Fig. 132). If the graft is secured by suture, the stitch " set " is required in addition.

example of clumsy disproportion) a pair of pointed "stitch" scissors, a pair of sinus forceps, a pair of plain dissecting forceps, and a curette (Fig. 130).

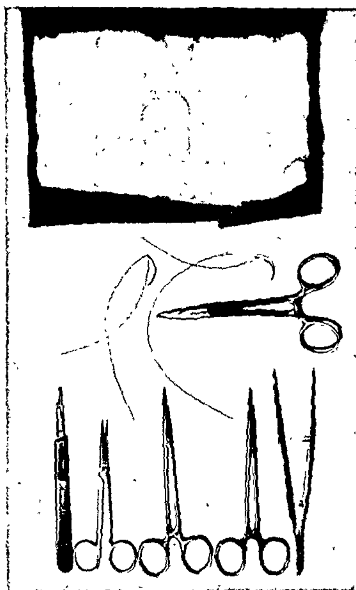


Fig. 131
This equipment will suffice for the suture of a lacerated wound, or the suture of an abscess cavity. Note the size of the suture needles. These are for skin suture. An abscess cavity may need larger ones (The forceps are toothed.)

A second container with needle, fine nylon threads, needle holder, and fine toothed dissecting forceps may be called in if it is decided to carry out primary suture. This "set" with the addition of two or three pairs of fine artery forceps and a pair of "stitch" scissors will also suffice for the closure of most lacerated wounds (Fig. 131).

Casualty Ward and Accident Ward.—Many of the cases described in this book were treated at some stage as In-Patients. Any minor surgical procedure may need admission for one or two nights because of the general condition of the patient, and particularly because the administration of an anaesthetic, or recovery from it, calls for extra care. Many cases are admitted for twenty-four or forty-eight hours as a precaution (pp. 187 and 188) or for observation on the chance of complications setting in. Many cases of virulent infection should be admitted for antibiotic therapy, or operation, or both, even where an isolation ward is not available, and they are unsuitable for a general surgical ward. Many cases which it is intended to transfer elsewhere (pp. 227 and 237) require resuscitation and preliminary treatment before they can be sent on. Some cases are obviously moribund when they are admitted, and sending them to a general ward has an undesirable effect on the other patients.

On all these counts it is urged that casualty or accident wards should be an integral part of the hospital organisation, and that they should be subdivided into cubicles. It is further considered that the best administrative arrangement is for them to be placed under the control of the casualty officer and casualty room nursing staff, that they should be situated close to, or actually be a part of the casualty premises, and near the main traffic stream between the entry to the hospital and the operating theatres. Accommodation in this ward should normally be limited to a period of forty-eight hours, before the end of which the cases are either discharged or properly admitted under the care of one of the In-Patient staff.

They may also be used, if the staff so wishes, for the pre-operative accommodation of surgical emergencies (especially at night), so that the general wards may be relieved of the noisy interruptions associated with their admission and preparation for theatre, and for the preliminary treatment of some medical emergencies such as attempted suicides by poison or inhalation, cases of immersion, and inebriation.

Such an arrangement has not yet found universal acceptance, much less general adoption, but the writer is not aware of any hospital which, having adopted it for one or more of these purposes, has shown any wish to reverse its decision.[1]

Records.—The greatest interest to be derived from work in the casualty department comes from the evidence of steadily improving results and steadily diminishing averages of disability (Appendices III and IV). This evidence depends on accurate records. Few cases need elaborate or lengthy histories, but there are certain essentials. If the casualty officer analyses his own results, and bequeaths the analysis to his successors, a mass of information is rapidly accumulated from which new lines of treatment may be established.

[1]A report from the Hospital Administrative Staff College of King Edward's Hospital Fund for London does *not* recommend the casualty receiving ward, but its functions are somewhat different from those proposed in this section

A tray is available containing sterile artery forceps, Allis' forceps, probes, and other instruments in less frequent demand. Items from it may be used to implement the standard " sets " when they may be called for.

An intelligent arrangement of the operation order will allow combinations of these " sets " to be used in such a way that the accessory " sets " need not be available for every case. Six basic, two or three stitch, and one skin graft " sets " will be adequate for the most formidable list.

Such a system demands a larger outlay on instruments than is usually considered necessary, but the outlay is offset by the fact that wear and tear is more than proportionately reduced. Preparation and sterilisation can be carried out without undue haste and without throwing the instruments about.

The staff must adopt an uncompromising attitude to those who would stock its department with discards from the main theatres and other parts of the hospital. The casualty theatre stands upon its own merits, every operation is a proper operation and nothing but the best is good enough if the best results are expected.

Recovery Room.—The smooth and safe working of an operation list in the casualty department depends to a large extent on the accommodation for patients recovering from an anaesthetic. They should be transferred to the recovery room as soon as they are fit to be removed from the immediate surveillance of the anaesthetist. The recovery room must be adjacent to the theatre, so that the anaesthetist can look in from time to time to see that all is well. A nurse must be on duty as long as patients are in it. So that all patients can be seen at one glance complete screening or separation in cubicles is *not* recommended. The patient should be covered as much as convention demands before he leaves the theatre, and there is therefore no necessity for segregation of the sexes. If one nurse is to be responsible for five or six cases she must be able to see all their heads (at least) at the same time.

Resuscitation Room.—The practice in most hospitals is for any severely shocked patient to be admitted at once and resuscitated in the wards. There is a growing tendency however for casualty departments to take over some of this responsibility, and patients may require treatment for shock as a preliminary to transfer elsewhere (p. 237) Modern casualty departments should have a separate room in which emergencies can be examined and diagnosed. It should have equipment available for the immediate institution of treatment for shock, as well as such pieces of equipment as splints and dressings, an injection tray, a B.L.B. or similar mask with an oxygen cylinder, a tracheotomy packet, and many other armamentaria which lie about for months and tend to be missing when they are at last wanted.

If a casualty ward is attached to the department the resuscitation room is arranged as an annexe to it.

A note when certificates are issued may be of value. A note whether an accident is claimed to have occurred at work or not is indicated in all pertinent cases.

No department can claim that its records are complete. Some cases default in the middle of their treatment, or attend other clinics or practitioners. Some are travellers or troupers and their treatment is carried out in many places. In assessing results such records must be discarded.

Where a continuous series of analysis is maintained, with a changing population of casualty officers, it is advisable to lay down criteria on which incapacities are based, and to hand them on to succeeding incumbents. What those criteria may be is of less importance than that they should be observed in spite of changes in personnel. Thus, it is immaterial whether a septic hand is discharged to the care of the family doctor as soon as the infection is overcome, or retained until the wound is dry, or retained until the scab is shed leaving an epithelialised surface. So long as all cases for assessment are judged by the same standard, it is possible to obtain reliable comparisons. Casualty departments which make vigorous efforts to maintain continuity in clinical records automatically make progress from one surgeon to the next.

Records of obvious defaulters are omitted, although they include a number of cases which get a quick response to treatment and do not return to say so. Those who do not attend for their official discharge after a reasonable course of treatment may be assumed to be cured and should be counted up to their last attendance. Those who delay attendance for their official discharge on the prospect of stealing a few extra days' incapacity must be counted up to the end of the stolen period, for it is actual incapacity which must be assessed, not what one thinks the incapacity should be. Following the same argument, all cases with adequate records must be included, even though unusual or unforeseen complications have spoiled the clinical picture, or an uncooperative attitude has extended or aggravated the disability. Only in this way can one obtain standardised results, which can be checked against the results of other periods. Once the surgeon begins to discriminate, a personal bias is introduced which destroys the objectivity.

Investigation.—The rapid turnover, quick results, and large number of cases available makes the casualty department better than most others for short clinical trials of new methods. *Six to eight weeks' work may be enough* from which to draw reasonable conclusions. In the average clinic, for instance, each month may be expected to see twenty cases of paronychia, twenty cases of pulp space infection, and twenty-five cases of subcutaneous or web space abscesses (see Appendix III). An appointment lasting six months may give an opportunity to raise a number of points from the dubious position of a "clinical impression" to the dignity of something "statistically significant."

In many types of case much of this information can be standardised, and a facsimile of the record for hand cases is reproduced below (Fig. 133). To complete this case history takes a very short time. The space on the right is

Surname (Capitals)

Christian Names

Address | Age | M.S.W.

Occupation | Own Dr.

THE ROYAL INFIRMARY, SUNDERLAND

HAND CLINIC

All attendances at 9 a.m.

Date of first attendance

HISTORY

No. of Days

At Work or not

Previous Treatment

X RAY FINDINGS (*if any*)

CLINICAL DIAGNOSIS

I hereby give consent for the administration of an Anaesthetic and for the performance of such Operation as the Operating Surgeon may consider necessary for my welfare/the welfare of

SIGNED -

(Patient if over 21 years of age Parent or Guardian if under 21 years)

Date

FIG 133

for volar and dorsal diagrams of the hand, and it is filled by a rubber stamp, according to whether the left or right hand is affected. This stamp may be used again where continuation notes or operation reports might indicate it.

Bacteriological and radiological reports, even when submitted on a *separate form, should be summarised on the case sheet because they are often* mislaid.

CHAPTER XIII

THE FINANCIAL AND TEMPERAMENTAL BACKGROUND

ONCE the patient has realised that his condition is a trivial one, and that it can be treated as an Out-Patient, his attitude is strongly coloured by the effect it will have upon his life, his social relations and his income. Out-Patients may be more affected by these non-medical considerations than In-Patients, whose main concern usually continues to be the medical condition from which they suffer.

This is a vast field for enquiry, and the following notes are not intended to be exhaustive. They introduce only a few of the problems but they include those affecting the decisions on disposal which a casualty officer may have to make, and they describe a few of the organic lesions which may be particularly influenced by the patient's attitude to his injury, his work, and to society.

Certification and payments under the National Insurance Act of 1948 (which incorporates the principles of the old Workman's Compensation Acts) play a very large part in this matter, and very often a patient may be more concerned that he receives the proper certificates than that he receives the proper treatment. He is, in any case, more competent to judge the former than the latter.

In most occupations incapacity for work results in a very drastic reduction in the standard of living. The net income may be reduced by half. In all but a minority this impels the patient, at the beginning of his period off work, to return as soon as possible, and if possible, to reverse the doctor's decision that he must be off work at all. There is the danger, however, that the longer he is off work the less these motives operate, for he becomes used to the lowered standard, and he becomes used to, if not actually enamoured of inactivity. Those with the longer incapacities, therefore, are prone to produce functional disorders subconsciously designed to excuse their return to responsibility, or to employ subterfuges directed towards the same end. It is in the patient's own interest, as well as in that of the national economy, that these should be recognised.

Certificates.—A medical practitioner is required to supply without charge a variety of certificates. For the majority of these the patient should be referred to his own practitioner. A hospital officer is in no position to certify a patient as eligible for most of the quasi-medical benefits whose dispensation has now been placed in the hands of the medical profession.

Certificates of incapacity (Med. 1, Med. 2A, and Med. 2B) from sickness or accident may be supplied. Some family doctors are inclined to regard this

Innovations are introduced in two stages, firstly, an investigation period in which alternate cases are treated by the established method, as controls, followed by the adoption of the innovation as a routine if the investigation justifies it. At the end of the year the average disability is estimated of all cases, including the controls, and any overall improvement on the previous year is assessed. As long as the averages continue to fall the innovation is continued. It must justify itself both by short-term (investigation) standards, and by long-term (annual) results. Any investigation on any reasonable premise is apt to produce a temporary improvement in results by virtue of the increased interest in and attention to the subject. To be of established value the improvement must be sustained beyond the period of particular attention, and must reflect itself in the annual figures.

Comparison with other published results from treatment of similar lesions must be made with reserve Conditions of work, both for patients and for surgeons, vary between different clinics to such an extent that no reliable deductions are likely to be made from minor differences. The only reliable evidence that any innovation of treatment is a profitable one, is to establish that it has resulted in an improvement over previous methods in the *same* clinic. The necessity to stand up to this test is the principle clinical indication for keeping accurate records, as well as the principle source of satisfaction for the surgeon himself.

The results quoted in this book are all compared, not with other published results, but with results obtained for the same conditions in the same clinic in previous years.

Any improvement is compounded from the merits of the innovation and the demerits of the method it supplants. When the standard is low and the average results are bad improvement is easy. The next and subsequent steps are tested increasingly severely. Consequently if curves are plotted expressing the average disability they flatten out as the years go by. A 5 per cent reduction in a good clinic may be more meritorious than a 50 per cent. reduction in a bad one, and a true estimate of the value of any change can only be made against a backgound of the clinic's history.

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Extra attendances to obtain N.H.I. certificates are not necessary. They encumber the department if they are allowed to occur. A popular belief with patients and doctors is to the effect that intermediate certificates must be issued at exact weekly intervals. The doctor is, in fact, instructed to this effect on the cover (para. 3) of the forms. In most cases attendances are frequent enough for a clinical visit to correspond with the day for a certificate, but if the clinical indication is that the patient attends on his eighth, ninth, or tenth day, a certificate at that time is generally accepted for the full period. Most offices of the M.N.I. adopt a very reasonable attitude over this and appreciate that unnecessary work can be avoided by some latitude in interpretation of the regulations.

An attempt should be made to understand the attitude of mind of the working man who has suffered minor illness or accident. Much misunderstanding and resentment can be avoided by a few words of explanation on dismissal.

Many patients believe their incapacity should last for an exact number of weeks. They will therefore wish to postpone their discharge for a number of days if they are cured at any other time than at the end of a weekly cycle. If the casualty officer accedes to this he will be responsible for the loss of many half-weeks by the end of the year.

A workman who returns to work in the middle of a working week may be unpopular with his foreman because he upsets arrangements. He will therefore tell the doctor that he " cannot " be taken on until the end of a week, which is not—or should not be true. Peculiar conditions of work, either genuine or alleged, are not an indication for the doctor to extend an incapacity period. His functions are to certify a medical condition, and the termination of one, and nothing else. A warning at his penultimate attendance that he is about to be discharged may be useful for this patient, or his final certificate may be given earlier with the indication that he will be fit after three more days.

If the patient's incapacity begins in the middle of a week, he must pay insurance contributions for that week. If he returns to work in the middle of a week, he must pay contributions for that week as well. Such patients are at a disadvantage compared with those fortunate enough to contract disorders on a Monday and be cured of them on a Friday or Saturday.

If he returns in the middle of a week his pay for the remainder of it will be carried over into the next week's pay packet. His sickness or injury benefit will cease at the middle of the week and he will regard this situation as a " loss " of two or three days' benefit. It is, in fact, a gain to him in the end, because pay for a working day still usually exceeds sickness benefit for a day, but he regards it as a loss because it has been postponed. His mind never travels beyond the immediately impending pay day. His household budget is a weekly one and as often as not he has no financial reserves to carry from one week to another.

provision by the hospital as an usurpation of their own position, and a practice which drives another nail in the coffin of the doctor-patient relationship. Other practitioners (the majority) will welcome relief from any items of service of this nature, and are well content. It seems wasteful of everyone's time for a patient to go to one end of the town for his treatment and to the other, maybe, for his certificates. Others take the very reasonable view that they cannot conscientiously certify a patient as suffering from an illness or an injury on the sole evidence of a bandage they have been requested not to remove.

The casualty officer should issue any incapacity certificates for the National Health Service that he considers reasonable. The patient should be told to go to his own doctor, to say he is under treatment at the hospital, and that the hospital will be responsible for certification as well as treatment if the family doctor agrees. After this civility the family doctor will usually agree. Where possible a note to the doctor should accompany the patient.

There are definite advantages to the economy if the casualty department undertakes certification as well as treatment. Under present conditions the family doctor may be under certain constraint to agree to prolongation of incapacities to the maximum. Patients can apply sanctions to their own doctor when sent back to work against their will. Though the doctor will consult his clinical judgment in these cases, he will often welcome release from unpleasant or unpopular decisions. The casualty officer is in an independent position, and can adopt a firmness of attitude which is the envy of the general practitioner.

So far as is known, only perfect communications between hospital and practices can prevent a patient, who has been given a final certificate, from tearing it up, reporting to the family doctor that he is returned to his care, and getting another week or more off work on the practitioner's certification. The doctor may require this interim period to assess progress because it is unlikely that he can decide that a case is fit for work on first sight, unless he has the hospital opinion promptly. Such loopholes exist in all systems and a determined opportunist will find them. Though probably disapproving of these practices, it is not the function of the hospital officer to go out of his way to detect them.

If he is satisfied that the condition is the result of an injury or accident, he will simplify procedure both for patient and Ministry officials if he uses the word " injury " or " wound " in his diagnosis. He should further specify the particular member, in case a previous or subsequent injury should become confused with it. Thus: " Injury to right wrist," " Injury to left ring finger with sepsis," " Lacerated wound of right foot," and so on. It is no part of his duty to certify that it happened at work. The onus for this is on the patient.

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officers are required, under the Health Service Act, to provide certificates at the patient's request, without charge, for submission to an interested third party, provided:

1. Such provision does not demand examinations or consultations other than those carried out for clinical reasons.

2. Such certificates or reports are not intended for use in the Courts of Law.

3. Such provision does not interfere with the proper function of clinical duties.

At the present time the third proviso is not likely to apply; but the amount of work required for certification tends to increase steadily as the years go by. Any casualty officer who finds that a disproportionate amount of time is taken up with it is entitled to report on it to his Hospital Management Committee and to request clerical assistance. He will be well advised to quote facts and figures in support.

In the first instance, requests for certificates other than for the N.H.S. may be referred to the patient's practitioner. If he is unable to supply them the casualty officer may do so.

Secondly, branches of the M.N.I. are empowered to inform approved insurance societies that an individual has submitted National Insurance Certificates, if he requests it. (No one must issue N.H.I. certificates in duplicate, but a certificate alleged to be lost may be repeated with an endorsement to that effect.)

Thirdly, many employing authorities are satisfied with scrutiny of the N.H.I. certificate before it is sent in, and this is the most acceptable procedure from the point of view of reducing paper-work.

By using one or more of these devices the casualty officer can make available for himself more time for the fulfilment of his clinical duties.

Certain unions, employing authorities, and private insurance companies have benefit schemes whereby the Ministry payments are supplemented, and the patients are furnished with forms of varying character which they submit to the doctor for completion. Many of these require information outside that normally acquired in the course of treatment. Some require an opinion on the length of incapacity. Some require so much attention that they approximate to the report of a specialist's examination. Any of them are liable to be used in legal processes should indication arise. The medical man is entitled to charge a fee for completing them, and he should enquire of the local B.M.A. secretary whether a fixed fee has already been agreed between those issuing the forms and the B.M.A. If he completes such a form he should keep a copy of his report in case he is required to endorse or amplify it at a future date.

Those who have an appointment of a few months' duration are advised to avoid this type of work, even though it means foregoing an addition to

Much futile controversy on this problem is from a failure to appreciate that, unlike planners, administrators, and managers, the patients in a casualty department live a week-to-week existence and leave the future to take care of itself.

Very few occupations, if any, exist in which sickness or injury benefit payments exceed the normal wage. If such a situation ever occurs the position of the medical profession will become intolerable. It is possible, however, for a workman to have a higher *net* income when he is off work than when he is working Injury benefit is not subject to income tax. He may have supplementary allowances from private insurance societies, he may be successful in persuading the authorities to grant him a special hardship allowance, he is excused his insurance contributions while he is ill (except under the conditions referred to above) and if he is employed on piecework rates his firm may be going through a slack period in which the pay packet he is missing fails to compare with his " income " during incapacity.

There are, in addition, many employing organisations which make up any benefits to the normal wage for a varying period—usually for the first fortnight. As a result many working people regard this as a licence to enjoy a fortnight's incapacity annually. The attitude is typified by an overhead remark of a hospital employee making her annual arrangements; " I've had my fortnight's holiday but I haven't had my ' sick '."

The other side of the picture must be appreciated with at least as great an emphasis. Employing organisations report two apparently conflicting impressions. Firstly, they note that the introduction of benefit schemes to reduce the financial anxiety associated with incapacity, results almost at once in an increase in the amount of " sickness " in their staff, until it reaches the average incidence in other firms which have already made similar changes. Secondly, they approve of the introduction in spite of this, and have no wish to return to their *status quo ante.* Many workmen, who have previously been driven back to work too early by financial considerations, are enabled to complete their convalescence and reflect the benefit of it in their efficiency. Many others, who have previously been unable to contemplate an operation of election or a course of treatment, can undertake it with similar benefit. The introduction of such schemes, therefore, is followed by a notable improvement in relations between employers and staff.

Those responsible for medical certification should be aware of these situations, and take them into consideration when assessing a patient's abilities and matching them against his protestations.

The casualty surgeon may be requested to furnish further certificates for use at the patient's place of employment, with union officials, and so on. This certification can become a burden in certain districts, and is a source of some difficulty and even friction. General practitioners have by tradition been entitled to a small cash fee for supplying these certificates. Hospital

Employees in industry are constantly subjected to minor trauma, and take little notice of it. It is still very much a matter of chance whether they get proper recompense when a trivial injury gives rise to incapacity after an interval. It should be remembered, however, if a workman maintains that his failure to report an injury at the time was due to his belief that it was unimportant, and subsequent developments have shown him to be wrong, that this is a legally valid excuse. Also, in many cases a workman who submits a certificate to a National Insurance office may there be asked if he wishes to claim injury benefit, and the office will make him aware that the certificate he has submitted may qualify him for it.

The principles embodied in the National Insurance Acts are here to stay, and it is part of the doctor's responsibility to assist their application quite impartially. They have been accused of much abuse, and many instances of such abuse occur in the experience of every casualty officer. Although he will resist such attempts—out of self-respect if for no other reason—he should not pass to the opposite extreme and regard all claims as deceitful. Much good comes from the system and he should see that it is directed to the right quarters

Malingering is almost non-existent. Malingering is defined as the simulation of a disease or injury without any basis other than a desire for gain. This is not the same as hysteria, which is the simulation of a disease or injury without any organic basis. Both are far removed from the common condition, which has no scientific name, and which arises from one of two impulses. In the first the disability from a disease or injury is consciously exaggerated in order to attract sympathy, to prolong incapacity, or to continue receiving benefit after the patient has ceased to be entitled to it.

In the other, an attempt is made to attribute a disability which has been acquired from uncertain sources, to working conditions which could have given rise to it, but which in fact have not. From the casualty officer's point of view this latter type can be dismissed at once. It is not part of his responsibility to determine whether the condition is due to or contracted at work, and he is unlikely to have a valuable opinion on it; except in the rare case where an accident is alleged to have happened to a member of his own staff in his own department. It may be important for him, however, to have a note on such a point in his clinical records, in case the patient's "story" is changed at a later date, and an attempt is made to call him in evidence when the details of the case have been forgotten.

Unwillingness to return to work is compounded of more factors than these. Many workmen suspect their disability will reflect on the efficiency of their workmates, and are genuinely afraid of "letting down the side." Many are afraid (often justifiably so) that their clumsiness or lack of practice will expose them to further injury. Many are afraid their scars will prove more painful than actually occurs. Many others use any or all of these reasons as an excuse, when the basic reason is inherent idleness. Very valuable advice

their income. It is seldom that court procedures mature within six months of the causative incident, and a house officer may find himself called back to a case, at great inconvenience to himself, after his professional progress has settled him many miles away. Even when no court procedure is contemplated, he may be asked further questions when he is separated from the clinical notes and thus be put to some embarrassment. Efforts should be made to refer it to colleagues who are more permanently situated.

No certificate should be given to a proxy. No certificate should be given without verification of the condition and without personal clinical knowledge of the patient. No certificate should be post-dated to save attendances. The time-honoured practice of signing a series of blank certificates for completion by members of the clerical or nursing staff is entirely reprehensible, both from legal and professional points of view.

Accuracy in filling in certificates saves much work in hospital and National Insurance offices. Many cases are checked in order that the disability as certified and the period of incapacity can be reconciled. If the wording on a certificate implies a disability which is expected to be a short one (e.g., " bruised shoulder ") when in fact the condition gives rise to a long absence from work (e.g., a severely torn supraspinatus tendon) the patient may be subjected to much unnecessary trouble at the hands of tribunals and examination boards.

Injury Benefit.—It is within the province of the casualty department to offer advice to the injured workman—especially the young one—on claims for injury benefit. Inexperienced patients may discover their title to injury benefit some weeks after the incident, and requests for certificates which are long overdue demand extra work in offices as well as extra time in the casualty department looking backwards through clinical notes. Any workman who believes his condition is due to an accident at work or to his working conditions should report it to his employer immediately after it has occurred. In cases where such a claim must obviously be sustained the casualty officer may recommend this course of action if it has been neglected. He should not encourage claims of doubtful merit, and should not create an atmosphere suspicious of partisanship either for or against the workman. He should avoid giving an opinion to him which he would find difficult to maintain in a Court of Law.

There are still many anomalies. The same surgical condition may attract injury benefits in one case and sickness payments in another. Thus, a case of pulp space infection which can (or alleges he can) remember a particular incident when he sustained a penetrating injury, and who reported it at the time, will have no difficulty in obtaining injury benefit. The next case with a similar or worse lesion, who never noticed any particular event, will qualify only for a less amount—for " sickness."

Employees in industry are constantly subjected to minor trauma, and take little notice of it. It is still very much a matter of chance whether they get proper recompense when a trivial injury gives rise to incapacity after an interval. It should be remembered, however, if a workman maintains that his failure to report an injury at the time was due to his belief that it was unimportant, and subsequent developments have shown him to be wrong, that this is a legally valid excuse. Also, in many cases a workman who submits a certificate to a National Insurance office may there be asked if he wishes to claim injury benefit, and the office will make him aware that the certificate he has submitted may qualify him for it.

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can be given by the casualty officer who understands these problems, who has the intelligence to distinguish and accept genuine protests, and who has the firmness to refuse the others, at the same time as allaying any specific anxieties he may detect.

Once the man gets back to work his resistance usually vanishes. Within a few days his confidence is re-established, the repeated function of his injured member, in the ways it is used to, does more to restore his ability than twice as much organised exercise, and his rehabilitation is complete. To announce that he is fit when he thinks he is not, and bully him into a return, is as harmful as to agree that he is not fit when he is. If he is sent back with the advice that a return to work at this stage is the *most effective method of completing his recovery*, cooperation is almost invariably obtained.

This attitude, an exaggerated "Monday morning feeling," accounts for the great majority of those who attempt to prolong their certification beyond its proper period. A patient and sympathetic approach will overcome most of the difficulties connected with it

True hysterical palsy in the injured workman is rare, though not so rare as malingering. It is usually outside the province of the general surgeon and should be referred to a psychiatrist.

Compensation Neurosis.—Some reference to this condition has already been made (p. 163). Compensation neurosis is usually a clearcut form of anxiety state with a specified basis. It is a disease, not a form of malefaction. Apart from its association with the conception of monetary reward for an accident, it differs little from any other psychiatric condition. It may be neurotic, obsessional, hysterical, or complicated. It is not true that its features *invariably* disappear on settlement of the claim. In fact, only the milder forms, in those with a relatively stable personality, will be cured by this event. Many cases, when well established, are permanent, and the unfortunates must be written down as a total or partial loss, not only to industry, but to society. Assurances that there is nothing the matter with him, cajolery, threats, duress, and the like have no hope of curing this type of patient, because his conviction that he is incapacitated is stronger than the doctor's that he is not. His inability to concentrate, bad memory, lack of self-confidence, and obsession with the circumstances and results of his injury, are of much greater moment, and a much more potent cause of inability to follow any form of employment than such physical crippling as may have resulted. He gives the impression that it is life itself which has defeated him, rather than the accident. The impression is frequently a correct one, for there is very often a background of inadequacy upon which the compensation neurosis is developed. The effects of trauma which a robust personality can shake off with never a glance behind, persist and magnify in him. The accident comes as an opportunity to escape from responsibility with some pretence of dignity, and the excuse is clung to long after the pretence has worn thin. Perhaps

this is why a settlement does not always produce a cure. Escape from reality may be as important a factor as the money involved.

He is often a worthy, conscientious person. He has often been a good workman. He may even be distressed at his condition rather than apathetic. He expresses a wish that he were fit for work, while remaining convinced that he is not. He is caught in a vicious circle. As his period of incapacity drags on, and the prospect of his return becomes more and more remote, his anxiety becomes greater. As his anxiety increases, his prospects become more gloomy still. The more he lingers around Out-Patient clinics, ill-served with placebos and unconvincing assurances, the less chance he has of recovery.

The casualty officer can be of service in two ways, and probably in no more. He can be aware of the condition, and detect its early signs. Much prevention can be done by intelligent handling of those unwilling to return, as has been discussed above, and once they have actually returned, for many of them the battle is won. A little attention to return of function in the early stages (p. 69) may prevent cases of neuro-muscular disorder. A word at the right time may reorientate the patient's ideas on compensation payments and the greater value of a restored earning capacity.

Secondly, he can avoid making the condition worse. Ways in which it is made worse are many, but the commonest of all is to allow the patient to continue attendances at surgical clinics (including casualty departments) in the hope that he will ultimately get better; to attempt to assure him that there is nothing the matter with him, and that he is fit for work—both of which are untrue, as the patient knows well enough—to send him on a useless round of consultations to other clinics, or to accuse him of malingering.

It is better that he should be told at the beginning that the casualty department can be of no use to him—for it cannot—and require of his family doctor, or whoever has referred him, to make other arrangements. At the present stage in development of the medical services, certain areas may be ill-provided with means to assist him. In others, rehabilitation centres, or psychiatric Out-Patient departments, or both, are paying increasing attention to his problems and offer prospects of improvement in results. Where these services exist the casualty department may be able to arrange for him to be seen and treated. Where they do not, it is useless to pretend that a department intended to treat minor organic conditions has anything to offer those suffering from functional disorders demanding specialised skill and an almost unlimited amount of time.

It is not easy to announce to a patient who attends *per primam* that one has no advice to offer, although this is the only honest attitude to adopt. It is more difficult still to know how to dispose of cases which develop a compensation neurosis in the course of treatment in the department itself. Responsibility for these has already been accepted, and a time must come when the surgeon realises that the organic has taken second place to the psychiatric lesion. At this stage he should explain to the patient as much of

his opinion as he considers diplomatic, and enlist the assistance of the psychiatrist, the rehabilitation officer, or other suitable colleague. His decision should be made early rather than late. The condition is a cumulative one.

It can already be inferred that many of these cases are attributable to faults or misfortunes in early treatment, to unenlightened handling of the patients, to delay in healing, or to the unanticipated development of permanent deformities or contractures. Cases with which the casualty departments are concerned are unlikely to be of great severity from the organic point of view, though their functional severity is often out of all proportion to the magnitude of the lesion. The most important and successful way of avoiding the incidence of this condition amongst the cases in one's own department, therefore, is to get the patients well of their organic conditions swiftly and effectively; to maintain an atmosphere of optimism and efficiency; to establish a reputation for rapid recovery and good results—to be good at the job. If everyone gets better in a few days no one has time to become neurotic.

Physical Disorders, often associated with Compensation and other Neurosis.—Not only psychiatric conditions, but certain gross pathological ones result from minor injuries which attend casualty departments for treatment. The relationship of these to neurosis is not precisely established, but there is a definite association between them. An injury, plus an emotional instability *will give rise to them, whereas a similar injury in one who is normally* orientated towards his work and the rest of his environment will be rapidly and completely overcome. The following sections describe certain conditions in which the *organic* results of the injury are greater than the magnitude of the injury might suggest. It is noted that the functional results are also often pronounced, and it is suggested that a functional instability may be one of the principal aetiological factors; but, whether caused by psychiatric disorders or not, the organic results are very real, and require active treatment. An early appreciation that this vicious circle type of condition is developing may, by the institution of treatment for the organic moiety, destroy the cumulative effect and allow the funcional disorder to be overcome. Alternatively, attention to the personal approach to the patient, and in particular the suppression of all irritation at his spiritless condition (a form of weakness in which unfortunately some doctors indulge) and the simulation of a sympathy which it is sometimes difficult to feel, will contribute to the effectiveness of active treatment.

A third factor may be present—failure of the early signs to be appreciated and failure in the institution of proper treatment. These disorders, on the borderline between functional and organic (with a foot in both territories) may be cured in their early stages, whereas every week of neglect reinforces their hold and makes them more resistant.

In a well established case, it is perhaps more difficult to decide which has come first, the lesion or the anxiety state. A crippled member, a quite un-

expected degree of incapacity from it, an atmosphere of suspicion and lack of sympathy which these patients occasionally arouse, and a steadily growing realisation that the prognosis may be poor and the treatment unconvincing and unsuccessful—all these are more than enough to cause mental stress. Even those of sturdy personality may be excused if they develop a functional disability on top of their original trouble. It is probable that, as knowledge about them increases, many other conditions at present of unknown or doubtful aetiology will be included in the same class (p. 100).

Certain symptoms and physical signs are common and any one case may be compounded of a variable number of them in varying degrees. They include vascular disorders (especially spasm, but occasionally paralysis), pain, sweating, atrophy, osteoporosis, and oedema.

Where the predominant feature is vascular disorder, a condition such as the post-traumatic dystrophy of Sudeck is manifested. Where the predominant feature is oedema, conditions such as the dorsal swelling of Secretan develop. Although such eponymous entities are described, they—and many others without classical descriptions—are probably all variants of some condition the fundamental features of which are as yet imperfectly understood.

Where pain is the predominant feature, causalgia is diagnosed. Sweating, atrophy of the subcutaneous tissues, rarefaction of bone, swelling around the joints, loss of hair, brittleness and deformity of the nails, a dusky purplish-red colour of the skin, excessive sensitivity, tremor, stiffness, and many other signs and symptoms may capture the attention of the clinician. One of the most constant features is that the severity of the condition is out of all proportion to the apparent cause. Commonly, though less constantly, there is at the time of examination an impression of hopelessness which, as already noted, often tries the patience and alienates the sympathy of the surgeon.

These conditions have been well-known, and well described as clinical entities, for many years. It is only recently that there has been an attempt to correlate them, and the suggestion that they are fundamentally a psychosomatic manifestation is only tentative. And it must be confessed that if this is an advance, it is largely an academic one, for not much improvement in prognosis has taken place up to now. An explanation of their causation is still far removed from the elaboration of measures to obtain good results. Special emphasis is laid on them in this place because the casualty department occasionally has the opportunity to prevent their development, and it is one which is frequently missed.

The Post-Traumatic Osteoporosis of Sudeck.—If the views of Leriche and others are accepted, the balance between deposit and mobilisation of calcium salts in the bones is dependent on the blood supply. An increased blood supply produces decalcification, and a *reduction in blood* supply tends to extra deposit. There are of course many other factors, both normal and abnormal, which may operate, but if attention is paid to the alterations in blood flow

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In a well established case, it is perhaps more difficult to decide which has come first, the lesion or the anxiety state. A crippled member, a quite un-

it is about the wrist) allows protection of the originating area while movement of tendons over it can take place. Thus a return to normal balance in the blood supply may be encouraged. If there is a fracture, such fixation is indicated in any case, and it is believed that this explains why association of gross bony injury with the condition is comparatively rare. Minor injuries, in which its development is unsuspected, and which have been encouraged to persist in unprotected movements in spite of the warning symptoms of excessive pain and superficial vascular changes, provide most of the cases. Active exercises below the pain threshold while the limb is in plaster must be encouraged. Instilling confidence in the patient that his condition will improve, and where possible encouraging an early return to some form of work are of equal benefit.

The injection of local anaesthetic around the affected joint has been recommended. It results in some temporary increase in range of movement, but even when repeated, is apt to awaken unjustified optimism, the reaction from which produces a worse mental state than before. Periarterial sympathectomy and ganglionectomy are to be considered in severe cases. Injection of local anaesthetics should therefore be reserved for clinics which are prepared to proceed with the more serious measures, so that those undertaking them may use response to injection as a means of estimating severity, or of judging prognosis. If the casualty officer has already carried out repeated injections much of their value is lost, and often much unwise delay has taken place.

Oedema.—Many cases of trauma produce a degree of oedema which may be suspected of being out of proportion. In those with poor circulation the lower leg may swell after small contusions, and attention to the oedema is indicated, not only on general principles, but because oedematous tissue is slow to heal and oedematous wounds are of lowered resistance and prone to infection. Much of this oedema arises because the injury is regarded as too trivial to interfere with normal occupations and a gravitational element is imposed upon the traumatic.

Occasionally oedema of the injured limb may be provoked by hysterical impulses which urge the patient to keep it dependent, or by frank malingering. Usually it is due to ignorance. A word of advice about keeping the feet up, or wearing a sling, or propping an injured arm with pillows while in bed, may be sufficient. The application of an elastic bandage, after all swelling has been dissipated by elevation, is all that is necessary in other cases, but it should extend from the toes or base of the fingers to above the lesion.

A few, however, may be included in the category of traumatic vasomotor disorders and, as already mentioned, oedema is common (though variable in degree) around the joints in the early stages of traumatic osteoporosis.

A clinical condition is described in which oedema is the most prominent feature, and minor degrees of it are not uncommon. It particularly affects the

an explanation can be found for many of the radiological findings in injury and inflammation (p. 37). If the limb is immobilised for any reason, the normal blood supply becomes *relatively* excessive, as fewer demands are made upon it. This gives rise to the osteoporosis which results from disuse. An injury resulting in temporary immobilisation, therefore, causes temporary osteoporosis, and as soon as the injury is overcome the bone consistency and the X-ray shadow return to normal.

For many years (since 1900) it has been recognised that in occasional cases, an injury may be followed by a *progressive* osteoporosis. The decalcification is often associated with oedema of the soft tissues, effusion into the joints, periarthritis causing limitation of movement, pain, both at rest and on movement, and the peculiar superficial vascular condition already described (p. 163) in which there is cutaneous hyperaemia associated with *coldness*. The skin feels cold both to patient and examiner alike.

Vasospasm is the normal reaction in traumatised tissues, but it is possible for the normal response to set up a vicious circle in which pain from *spastic vessels* produces a reaction which increases the spasm. In this condition it is considered that arterial spasm, with relaxation of the capillaries and smaller veins, may be the underlying cause.

The early X-ray appearances show a *patchy* decalcification and this soon becomes overlaid by the more general osteoporosis associated with disuse. The incapacity may progress to an extreme degree, and result in ankylosis and complete uselessness of the affected member. Many cases gradually recover a considerable amount of movement after a number of months, but when once established complete recovery is rare.

This condition is described in the hands and feet, but it has already been mentioned that significant similarities exist between it and some cases of periarthritis of the shoulder (p 100). Similarities between it and certain types of rheumatoid arthritis are also striking, and much work is still to be done on correlating all these conditions with conceptions of stress reactions which have received renewed attention since the discovery of cortisone.

It is not intended to go further than this into the various theories and tentative explanations of the condition. The object here is to draw attention to its existence, and to establish that, if it is diagnosed, and if it fails to respond satisfactorily to simple methods of treatment, it should be referred for more expert consideration before it is so firmly established that no one, however expert, is likely to obtain a rapid and complete cure. Minor degrees of the condition are not uncommon. The casualty department has a better opportunity than most others of detecting them early.

Encouragement of active exercises or the imposition of passive movements at the unprotected joint are unlikely to be successful, because pain on movement is genuine, and tends to get worse. *Absolute* fixation increases the decalcification and provokes the formation of adhesions. On the other hand, a walking plaster (if the lesion is in the ankle or foot) or a forearm plaster (if

an area which has suffered injury, and that certain cases become progressive. No explanation is forthcoming as to why the back of the hand is the only area commonly affected, except that here the loose areolar tissue is so constituted that a slight injury readily produces a visible swelling on which an anxious type of personality can focus its alarm.

Causalgia.—A degree of pain is an almost constant feature of the whole group. The subject has already been discussed in relationship to the painful scar (p. 163). If a precise " trigger point " for the pain can be detected, there is some prospect of relief in early cases from surgical removal of scar tissue surrounding the nerve-end and shortening the nerve itself. If gentle stimulation of a diffuse, ill-defined area provokes excessive response—especially when it does not correspond to the anatomical distribution of a peripheral nerve—local operation is likely to do more harm than good. This is a mild form of causalgia, the severer examples of which mainly occur after limb amputation, and for which sympathectomies, rhizotomies and tractotomies have all been tried with varying and unpredictable success.

Apart from excessive tenderness, it also gives rise to spontaneous pain, of a burning, gripping, or twisting nature, or to similar pain provoked by normal movement—with the result that the affected member is protected and held still, often in an unnatural (" hysterical ") attitude, and wrapped up in old shawls or scarves, and cossetted.

Causalgia may occur after partial damage to a nerve, as well as after complete nerve section. Indeed, it is believed by some to be commoner after partial damage. It should be distinguished from that stage in regeneration (after nerve suture) when returning sensation produces an excessive response to stimulation. The latter settles down to normal as the fibres grow distally. The prognosis in causalgia is more uncertain.

Causalgia in relation to the painful scar has already been discussed, and nothing remains but to reiterate that the chances of obtaining relief by surgical procedures such as can be carried out in a casualty department are much slimmer than the novice is likely to believe.

Trophic Changes.—Though the outlook for the majority of cases is reasonably good if the condition is appreciated early, and although an appreciation of the causes of the condition does much to improve the atmosphere in which they are treated, intractable cases may progress to true ischaemic lesions, especially in the extremities. The causalgic amputation stump or ankylosed digit may proceed to ulceration and gangrene. The condition is exactly comparable to that discussed with Raynaud's disease, and the treatment to be adopted is the same (p. 87). Raynaud's disease, and the ischaemic ulceration resulting from it, are usually bilateral. The trophic changes from traumatic vasospasm are localised to the region of the injury, or distal to it. The spasm of Raynaud's disease is usually episodic, whereas, though traumatic

back of the hand, and follows a blow to it or to the wrist. It is sometimes suspected at first of being a subaponeurotic haematoma, but the typical "rainbow" staining which reaches the surface from a haematoma after a few days fails to make its appearance. Many cases resolve spontaneously within a few days, particularly if the hand is continued in use, but if it fails to resolve, and pain on movement persists, further efforts to exercise the hand may set up a vicious circle in which the oedema becomes more emphasised, the swelling hardens, pain increases, and the dusky-red discoloration and coldness characteristic of these conditions may set in. This is the dorsal oedema of Secretan which is a cause of prolonged incapacity. It tends to spontaneous recovery, but only after some months. In a few cases the resultant stiffness and trophic changes are permanent (Fig. 134).

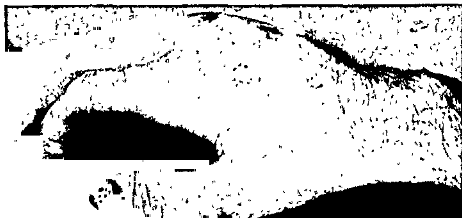


FIG. 134
Oedema on the dorsum of the hand, following trivial injury, may become progressively harder and more incapacitating. Its development may be associated with neuro-vascular tropho-neurosis. This case obtained marked increase in function after excision of all oedematous tissue and replacement by a pedicle graft. (Mr. F. I Herbert's case)

In these, as with Sudeck's disease, early immobilisation in plaster, with active movements and full use of the fingers and thumb, may result in resolution. As the oedema subsides plasters must be changed frequently, because the feeling of support is an important factor in restoring confidence and encouraging activity. A loose or cracked plaster is worse than none at all. Fixation must be continued until recovery is complete. If the case fails to respond to simple treatment an early decision must be made to refer it for consideration of more specialised surgical measures.

Incisions into the oedematous area, though they have been advocated in certain clinics, are not advised. Physiotherapy without fixation may be harmful.

The condition bears some resemblance to angio-neurotic oedema, which usually has an emotional basis, but it differs from it in that it is localised to

an area which has suffered injury, and that certain cases become progressive. No explanation is forthcoming as to why the back of the hand is the only area commonly affected, except that here the loose areolar tissue is so constituted that a slight injury readily produces a visible swelling on which an anxious type of personality can focus its alarm.

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vasospasm may be exacerbated by emotional upset or exposure to cold, some degree of spasm is always present.

Both types of ulceration or gangrene have to be distinguished from tissue breakdown caused by excessive destruction of blood vessels supplying the part. Ischaemia may result, not only from spasm of the vessels, but from an insufficiency of vessels, and this condition is not infrequently seen over the lower third of the tibia after skin loss from trauma. It may even occur in young subjects. Such cases are curable by pedicle skin grafts, which provide enough blood by the dermal vessels for skin cover to be successful; and obtaining skin cover in this way increases supply to the neighbouring bones and joints and improves their mobility. In these cases a vasospasm does not enter the picture, though the superficial appearance of the ulcer may lead to a wrong diagnosis. Sympathectomy is not indicated and there is not necessarily —or even usually—any associated functional disorder.

The treatment of established forms of these conditions (the " trophic neuroses," or " reflex sympathetic dystrophies ") is outside the territory of the casualty department, and the main object here (as in many other conditions discussed in this book) is to remind the casualty officer of their existence, and to increase the prospect of their recognition as clinical entities. Many are being treated with a combination of surgery on the sympathetic system and psychotherapy Good results are reported from the use of cortisone (in Sudeck's osteoporosis). But these are tentative advances, and the casualty department is fortunate if it has a nearby individual or clinic interested enough to offer some prospect of relief.

Rehabilitation centres are run by the Ministry of Labour, or by semi-public organisations such as the National Coal Board. There are not enough of them.[1] Some of them may look askance at patients suffering from mainly functional disorders, because the prospect of obtaining dramatic improvement is less rosy than for organic conditions in temperamentally healthy and admirable subjects. In most of them, however, up to one-third of the cases are mainly psycho-neurotic cases, and the results of treatment are moderately good.

[1] In 1953 there were twelve Industrial Rehabilitation Units under the control of the Ministry of Labour.

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CHAPTER XIV

DISPOSAL

UP to 15 per cent. (*see* Appendix) of cases coming to the department may require reference to other clinics or admission to the wards on first sight. The figure depends to a large extent on the medical habits of the area. In some it is established that practitioners make their own arrangements with consultants, in others most cases are referred through an appointments bureau. In a few, where the volume of work is small, the majority of Out-Patients come to the casualty department and the casualty officer is expected to make a provisional diagnosis and to impel the cases in the appropriate direction.

Even where the normal procedure is for direct reference from family doctor to the specialist, there remain many occasions where the casualty department acts as a sorting house, and a wide experience can be acquired by the casualty officer who arranges the disposal of cases and follows them up. Good relations are more successfully established and maintained with the staff in other parts of the hospital if he has time to go with the patient to the clinic concerned, and to discuss the case on the spot and at the time it is first seen. This is a counsel of perfection which cannot often be fulfilled, but the opposite extreme, at which all his patients arrive unheralded in special departments with a terse note conveying little or no information—or no note at all—will bring him discredit.

It is impossible to be precise in drawing a line between those cases which he can treat successfully himself, and those which should be referred for more specialised and experienced consideration. There is, however, a large number which, though strictly within the province of special departments, require no more than simple treatment such as the casualty department can provide. Every scalp wound, for instance, is a head injury; but no neurosurgical service to which all scalp wounds were transferred would welcome such a strict interpretation of their functions. In the same way other clinics appreciate some preliminary selection in the cases they are requested to treat.

Medical and Surgical Emergencies.—To lay down what type of case should be referred to a physician or surgeon, or to lay down what type requires admission to hospital as an emergency, would range over the whole field of medicine and surgery and would fill volumes in itself. It is becoming increasingly obvious, however, that this responsibility is a heavy one, and that the public is expecting a rising standard of efficiency in this respect. So is the Law. It is a state of affairs resulting in at least two developments of very doubtful merit—an increase in the number of occasions on which the

casualty officer will be inclined to call in further opinions before making a decision, and an increase in the number of admissions of " doubtful " cases. With present trends this cannot be avoided. Until someone else protects the casualty officer he must protect himself (Chapter XVI).

It is ironical that the last decade has seen changes in which the casualty department has shown itself able to cure many cases which previously required In-Patient treatment, and at the same time has had to admit cases which previously could safely have been sent home

The casualty officer should regard himself as a very important link on the chain of events which carries a patient to his definitive treatment. His admission diagnoses should be made with care, for he is often the first medical man to attach a diagnostic label to the patient. The In-Patient houseman, or the consultant himself, cannot but be aware of the diagnosis with which the case is admitted, and this creates a preconceived idea. He may have to dismiss it, but it is a more difficult mental process than to make a decision from a clear field. It is of great importance, therefore, that the diagnostic label should be the correct one as often as possible.

The casualty officer's responsibility regarding admissions may place him in an unenviable position, for he is assailed from all sides—from the public, the Press, and the Courts, if he summarily dismisses a case which later develops a serious condition—and from his seniors (or some of them) if he admits many cases which ultimately prove to have little the matter with them. A test as to whether he is burdening the In-Patient service unreasonably is to enquire whether the cases he admits have been discharged again *the same day.* If the In-Patient staff has not had the confidence to dismiss the patient on sight it cannot reasonably expect any more of the casualty officer.

Double Pathology.—A cross-section of the population passes before the casualty officer every day. The natural sequence of events will ensure that some of these patients attend complaining of some trivial or even imaginary complaint while actually suffering from a more serious one unassociated with it. The casualty officer should not concentrate upon the condition complained of to the exclusion of the more serious one. A cut hand may lead to thoracic investigation because he observes that the patient has clubbed fingers. He may look at a face while testing a sprained ankle for tender places—and diagnose a rodent ulcer. Many cases of diabetes mellitus are diagnosed because of attendance at casualty departments for recurrent infection (p. 15). Frequent or intractable infections of the fingers in young women—or indeed, in anyone—create the suspicion of Raynaud's phenomenon (p. 87). Three unsuspected epitheliomata of the lip have been diagnosed in the period with which this book is concerned, in an early, operable, and curable stage, in patients attending for quite unrelated conditions. The casualty officer has an opportunity—and a duty—to initiate investigations or treatment in such cases.

Head Injuries.—No other cases cause so much difficulty. Over no other cases, in spite of proper care and improvement in knowledge, are made so many mistakes. Probably no other cases occupy so many surgical beds to so little purpose. At a conservative estimate, two out of three head injuries admitted to hospital could equally safely be sent home to recover untreated. Some of those which have permanent sequelae with permanent incapacity, even if admitted to hospital, are sent home after a day or two without realisation of the poor prognosis. The aftercare of a head injury may be prolonged, may require specialised supervision, and may, in spite of it, be unsuccessful. The cause of this excessive admission rate is that, though only one out of three (let us say) requires highly skilled attention, it is impossible to tell which is the one until long after a decision has been called for on all three.

It has become the generally accepted rule that any case which gives a history of unconsciousness, even if symptom-free on reception, should be admitted for observation, and should be detained for at least twenty-four hours. This rule has arisen from the classical description of a middle meningeal haemorrhage, in which unconsciousness recurs after a "lucid interval" within twenty-four hours of injury. It will be as well, therefore, to describe certain other characteristics of middle meningeal haemorrhage, and of the "lucid interval," so that the casualty surgeon may have a sounder rationale for whatever decisions he makes.

Delayed signs of increasing intra-cranial pressure after injury are usually due to extra-dural haemorrhage, though not always to haemorrhage from the middle meningeal vessels. Other causes of extra-dural haemorrhage include injury to the dural sinuses and laceration of diploic veins. Altogether these probably account for no more than 1 per cent. of all admissions for head injury. The condition is therefore rare. Emphasis has been put upon it because for long it was one of the few types of closed head injury which were amenable to surgical treatment, and because of the obvious danger of dismissing a case while the threat was still upon it. The possibility of extra-dural haemorrhage in a few cases led to the establishment of the twenty-four hour rule for all. In fact, though the majority of cases develop signs within twenty-four hours, or not at all, cases of extra-dural haemorrhage with a latent interval of as long as a week have been reported. Other cases have occurred in which there has been no history of immediate unconsciousness. Although trauma severe enough to damage the extra-dural vessels is usually severe enough to cause unconsciousness at the time it is suffered, this is not always so. The "lucid interval" itself, whether completed within twenty-four hours or not, is not a *constant* feature of extra-dural haemorrhage. Cases with *unrelieved* unconsciousness may be due to the same condition, and may call for urgent surgical intervention. Twenty-four hours, therefore, may not give long enough to come to a proper estimate of the severity of the injury, and in

casualty officer will be inclined to call in further opinions before making a decision, and an increase in the number of admissions of " doubtful " cases. With present trends this cannot be avoided. Until someone else protects the casualty officer he must protect himself (Chapter XVI).

It is ironical that the last decade has seen changes in which the casualty department has shown itself able to cure many cases which previously required In-Patient treatment, and at the same time has had to admit cases which previously could safely have been sent home

The casualty officer should regard himself as a very important link on the chain of events which carries a patient to his definitive treatment. His admission diagnoses should be made with care, for he is often the first medical man to attach a diagnostic label to the patient. The In-Patient houseman, or the consultant himself, cannot but be aware of the diagnosis with which the case is admitted, and this creates a preconceived idea. He may have to dismiss it, but it is a more difficult mental process than to make a decision from a clear field. It is of great importance, therefore, that the diagnostic label should be the correct one as often as possible.

The casualty officer's responsibility regarding admissions may place him in an unenviable position, for he is assailed from all sides—from the public, the Press, and the Courts, if he summarily dismisses a case which later develops a serious condition—and from his seniors (or some of them) if he admits many cases which ultimately prove to have little the matter with them. A test as to whether he is burdening the In-Patient service unreasonably is to enquire whether the cases he admits have been discharged again *the same day.* If the In-Patient staff has not had the confidence to dismiss the patient on sight it cannot reasonably expect any more of the casualty officer.

Double Pathology.—A cross-section of the population passes before the casualty officer every day. The natural sequence of events will ensure that some of these patients attend complaining of some trivial or even imaginary complaint while actually suffering from a more serious one unassociated with it. The casualty officer should not concentrate upon the condition complained of to the exclusion of the more serious one. A cut hand may lead to thoracic investigation because he observes that the patient has clubbed fingers. He may look at a face while testing a sprained ankle for tender places—and diagnose a rodent ulcer. Many cases of diabetes mellitus are diagnosed because of attendance at casualty departments for recurrent infection (p. 15). Frequent or intractable infections of the fingers in young women—or indeed, in anyone—create the suspicion of Raynaud's phenomenon (p. 87). Three unsuspected epitheliomata of the lip have been diagnosed in the period with which this book is concerned, in an early, operable, and curable stage, in patients attending for quite unrelated conditions. The casualty officer has an opportunity—and a duty—to initiate investigations or treatment in such cases

Many head injuries are severely shocked on reception, and this creates the impression that their intra-cranial lesion is worse than is actually the case. The signs of shock and of concussion are practically indistinguishable in many of their details. X-ray examination in such cases will be postponed until measures to improve general condition have taken effect.

An examination of the nervous system is indicated in all cases where doubt exists. It is possible for a head injury to give rise to monoplegia, hemiplegia or diplegia without unconsciousness or other signs of more generalised intra-cranial damage. These paralyses may develop after a latent interval. One cannot admit everyone who has been hit on the head on the rare chance of such a complication setting in, but signs of limb weakness or alteration in the reflexes must not be ignored.

Head injuries occasionally give rise to isolated lesions of the cranial nerves, and if such are detected they are another indication for admission for observation. They, also, may be unassociated with more generalised intra-cranial disturbance which would give rise to giddiness, drowsiness, or unconsciousness, but they always indicate a severe degree of damage and the possibility of later relapse.

To summarise, unconsciousness, or a history of unconsciousness, is an absolute indication for admission, but it is not the *criterion*. Other cases, without it, may call for admission just as surely.

It is not proposed to discuss the classical signs of head injury, nor the treatment of the unconscious patient. These should offer no problems to the casualty officer, whose main responsibility is to decide upon disposal. It is the cases which have suffered a head injury, and who, when presented to him, have apparently recovered, or are showing unequivocal signs of recovery, which call for considerable acumen on his part.

All regions, and some areas, have already, or are in process of having specialised neurosurgical services. In most of these particular emphasis is laid upon the treatment of acute head injuries. The casualty officer in the general hospital may be of great assistance in sorting cases suitable for transfer to these special units, and may be able to make arrangements directly with them. Even severe head injuries usually travel well in the first twelve hours, provided treatment for shock is instituted, and the neurosurgical centre may prefer an immediate transfer from the periphery to a decision twenty-four hours later that the case calls for special treatment.

He may therefore consider transfer of:

1. Cases of *open* head injury (that is, compound fracture of the skull) which are not obviously moribund, which are not suffering from associated injuries (such as visceral, bony, or thoracic) demanding more urgent treatment, which are not shocked or which have recovered from shock, and which may be expected to withstand the journey. Depressed fracture in the adult is usually, but not invariably, a compound lesion In children this is not nearly so usual.

particular those casualty departments which include an observation ward (p 203) must bear this in mind.

Anyone who reports a moderate or severe head injury, either by direct or indirect violence, and who reports further that he is suffering from *increasing headache,* should be admitted for further investigation. Increasing headache is the most constant, and usually the earliest sign in the conscious patient of extra-dural haemorrhage. In these cases, whether the patient was or was not rendered unconscious at the time of the injury is beside the point. So is the fact that there are many other causes for the complaint.

Recent years have seen a realisation that there is little relationship between the presence of a fracture and the severity of damage to the brain, but the casualty department should use this knowledge in one way only. That is, it appreciates that an important brain lesion can exist without a fracture. It does not use the opposite argument—that a fractured skull can be sustained without any serious brain damage. Nor does it assume that there is no fractured skull because there is no clinical evidence of it. If violence has been severe enough to cause bony injury it has been severe enough to cause brain injury as well, and as long as the *possibility* of brain injury is present, the casualty officer must arrange for In-Patient observation. Every fractured skull should be admitted.

Whether a radiologist is or is not prepared to give an opinion on a film taken by a portable apparatus may be of some moment to the surgeon, but is outside the scope of this work. Radiologists differ widely on this point. If the case is conscious, admission to hospital via the X-ray department will save much time. If it is unconscious, it should be admitted direct, and the X-ray work done later, whether films on the portable apparatus are acceptable or not. It is valuable to get early X-ray evidence of bony injury, and if it is convenient it should be obtained; but it is not worth any added risk to the patient, nor any delay in the institution of treatment which is best done in the ward It need hardly be mentioned that extra-dural haemorrhage can occur without any bony injury, but where a case shows a fracture-line running across the course of the middle meningeal artery it should be regarded with suspicion, even when all other indications are absent.

The Courts pay great attention to the presence or absence of a fracture, and may hold a medical man negligent, or at least blameworthy, if he omits to arrange for X-ray examination. If the case is to be admitted, the onus lies on the In-Patient staff. If the casualty officer is confident that admission is unnecessary, he should arrange for X-ray examination in all cases where doubt is raised. Here again, one cannot recommend an expensive (and most expert) investigation on everyone who has a cut head, and he must use considerable judgment in selecting the cases. But he must err on the side of safety, and he will seldom, if ever, refuse to agree to X-ray examination of these cases if it is requested. It is impossible to eliminate a diagnosis of fractured skull on clinical examination alone.

rhage. If the case is already on the threshold of a special centre where definitive treatment is undertaken, a dressing may be all that is indicated.

The "Doubtful" Head Injury.—Every now and again much publicity is given to a case which is brought to hospital by the police, diagnosed there as an inebriate, and which dies in the police cell from the results of a head injury. The differential diagnosis between alcoholic and cerebral conditions is made more difficult by two facts:—

1. Many head injuries are given alcoholic drinks as a first-aid measure.
2. Many inebriates have suffered a head injury.

The early stages of cerebral compression give rise to excitement and many cases behave in a violent and aggressive manner. Their behaviour is distinguishable from "fighting drunk" only with difficulty, or not at all. Their breath may smell of alcohol. They may be drunk as well.

In this stage mistakes of disposal are made. If the patient is comatose, either from a head injury or from alcohol, the casualty officer will feel compelled to admit the case to hospital, for alcoholic coma is itself a serious if unsavoury medical condition, and carries with it a small but definite mortality. The unconscious patient, therefore, probably runs no more serious administrative risk than an admission to the wrong ward. A violent one is in danger of being returned home to the unskilled care of his friends, or of being detained in the cells; for this type of case, more than any other, is viewed with grave disfavour by all members of the hospital staff. It causes disturbance (usually nocturnal) in a ward which is quite undeserving of such uproar. There is a solid wall of disapproval around the receiving room if admission is considered.

Cerebral compression, in its excited stage, is most often confused with inebriation because inebriation is the only common form of non-traumatic cerebral disorder which has a well-marked phase of excitement. Excitement from alcohol may sometimes be identified by the observation that at least some vestige of reasonableness may remain. The patient is still capable of being influenced by an appeal. It is often of an illogical type; nevertheless it gives evidence that his mind is not entirely out of reach. With traumatic delirium no form of reasoning has any effect.

Both types of cerebral excitement are liable to progress into coma, and by this time differential diagnosis is less difficult. Gross central nervous system signs, especially if they be localising, are in favour of a traumatic origin. Inequality and abnormal reaction of the pupils are especially valuable. But by this time a wrong decision may have been made.

Whatever evidence he may collect in favour of a diagnosis, all doubtful cases must be admitted and the casualty officer must bear the opprobrium as best he may. We are discussing the *pons asinorum* of the department. The Law has many precedents upon it. The responsibility for these mistakes has been put squarely upon the hospital service. Division of this responsibility

2. Similar cases of *closed* head injury which have been injured for twelve hours or more, without apparent improvement.

3. Similar cases of *closed* head injury which have shown some improvement in the early stages, but which have begun to relapse.

4. Similar cases which have been unconscious for over an hour; for it is probable, from this fact alone, that intra-cranial haemorrhage has occurred, and the neurosurgeon may be inclined to treat some of them operatively.

No neurosurgical unit as at present constituted can accept every case of concussion which occurs in its region. The general surgical wards in peripheral hospitals will act as the main area in which these decisions are made; but occasions arise (not infrequently) when the casualty department can save much delay by doing so instead.

Scalp Wounds.—Scalp wounds require special consideration in connection with disposal, though their treatment as wounds does not differ materially from that of other lacerations (p. 110). In the majority no question of serious, or potentially serious, intra-cranial damage will arise. In some it will be obvious. In some the extent of the laceration and amount of haemorrhage may indicate In-Patient treatment on their own merits. Every scalp wound should, however, receive particular attention with the possibility of bony injury kept well in mind. Even small wounds may lie over a compound fracture.

The Out-Patient treatment of a scalp wound may indicate the use of local anaesthesia when a similar wound elsewhere might be sutured without it. It is advisable that the deepest part of the wound should be inspected. Probing the depths is an unreliable form of investigation except in very experienced hands, and the majority of surgeons cannot eliminate a depressed fracture unless they have *observed* a continuous sheet of tissue superficial to the bone, or the unbroken surface of the skull itself. It is occasionally forgotten that it is easier to detect a lesion than to be confident that a lesion is absent, and the knowledge gained by such procedures as probing is a case in point. Wounds which involve the galea usually gape and allow inspection without much difficulty, though haemorrhage may be profuse. Wounds superficial to the galea do not gape, and haemorrhage may infiltrate the surrounding tissues, providing the well-described dilemma in which the margins of the haematoma give signs difficult to distinguish from a depressed fracture. It may be advisable to extend such a wound by deliberate incision, in order to establish that the aponeurosis is intact. In the adult an unbreached galea very rarely hides a depressed fracture. The "pond" fracture of infants and children may be present without any wound of the scalp.

If there is no question of transfer, the wound may be sutured according to the usual routine. If transfer for further surgery is considered, many neurosurgeons recommend that the superficial wound is closed with a few sutures only, inserted in such positions as are most effective in controlling haemor-

syringing has not removed a foreign body and it is deeply inserted, it is not wise to proceed without the advice of the special department. Haemorrhage after acute trauma which cannot be explained by superficial injury also needs special advice. Where trauma damages the middle ear the case should be admitted. External lacerations may frequently be dealt with in the casualty department, but extensive damage involving much of the cartilage should be admitted for detailed repair.

Despite the fact that most acute lesions resolve nowadays with antibiotics and local treatment, most patients are frightened of having a " mastoid " and the casualty officer's main duty is in differentiating an acute mastoiditis or an otitis media from an external otitis. In cases of doubt no harm can be done in admitting the patient. For those who wish to attempt a diagnosis, the following points are given.

In *acute mastoiditis* the pain is intermittent, and worse on palpation over the mastoid tip or the antrum. A tender gland behind the ear or pressure forwards on the pinna itself in an external otitis may suggest this sign if care is not taken. The discharge is profuse and purulent, and it may be increased by pressure over the antrum. There is always some degree of deafness. The temperature is usually about 99 degrees. When swelling is present, it may be due to a subperiosteal abscess which lifts the whole pinna and the scalp up together, so that the cleft between them remains as acute as on the other ear. Inspection of the meatus after it has been cleaned will show it to be of normal size. The tympanic membrane shows signs of present inflammation (bulging and redness) or of old disease (perforation and scarring).

In *acute otitis media* the pain is also intermittent and may have already been relieved by the onset of aural discharge. Discharge may therefore be absent or apparent. Middle ear deafness is present in some degree. The temperature is elevated. There is no post-aural swelling, and the meatus is of normal lumen. If there is no discharge the normal landmarks of the tympanic membrane will be lost, the membrane itself may be red or beefy-looking, and there may be a bulge in the posterior segment, possibly pulsating. If there is discharge the appearances are similar but a perforation will be present with pus welling from it, and there is usually no bulging of the membrane.

In acute *external otitis* the pain is intermittent, and worse on moving the pinna or the tragus or during mastication. There is often swelling of the pretragal lymph node. Discharge may be sero-purulent or blood-stained, or it may be absent, and if it is absent the pain is severe and increasing. Unless the inflammatory condition has obstructed the canal there is no deafness. Temperature is variable, but may be normal. Oedema of the posterior wall of the meatus pushes the pinna forwards without involving the scalp so that the angle between the medial surface of the pinna and the scalp may be increased. This can be determined by reference to the other ear, but is not a constant finding. The lumen of the external meatus is obliterated and the walls are

between the administrative side, as an employing authority, and the medical officer, as an employee, will receive consideration later (in Chapter XVI), but even if the medical officer is relieved of any financial responsibility he is left in an unenviable position. Unfortunately, this and similar problems have ceased to be primarily of professional interest (for even those of great experience might well regard their professional consciences as clear) and have become of social and legal significance instead.

A somewhat comparable situation arises in connection with those medical diseases which produce unconsciousness. Elderly people may suffer from cerebral haemorrhage with such suddenness that they sustain head injuries which complicate the picture. Eclamptic, uraemic or epileptic fits, or the sudden onset of diabetic or hypoglycaemic coma, may cause scalp wounds, or even superimposed intra-cranial damage. Admission for the medical condition itself, in some of these cases, may not be indicated, but because there is an associated head injury (even a trivial one) there may be some doubt as to whether a reported fit, or a transient unconsciousness, may not, on the occasion under consideration, have been due to cerebral trauma. These cases, again, may have to be detained for observation even when the chances of a serious surgical relapse are slight. The problem here is usually not so much whether to admit, as where. A surgeon may prefer to have such cases under his own care until the clinical picture becomes more clear. A physician may advise admission to the medical side. Or either, influenced unduly by the present scarcities of hospital beds, may advise the opposite.

The writer's preference is for admission to the general surgical wards, for he believes that the development of surgical complications is likely to be more urgent and dangerous than a deterioration in the causative medical condition; and that, if deterioration does take place, a surgical cause is more responsive to prompt decisions and active treatment. The medical conditions, it is true, require vigorous therapy, but they may be treated while the patient is under surgical observation, with the cooperation of medical colleagues as it may be called for.

The E.N.T. Department.—A short conference with the E.N.T. surgeon and the ophthalmologist at the beginning of his appointment will save the casualty officer many occasions when cases are referred back and forth between the departments. Most hospitals maintain a twenty-four hour service for such cases, but the trend in these branches of surgery is towards conservatism since antibiotics have rendered many erstwhile dangerous conditions less urgent. Clinical acumen is not easily acquired but when it has been many attendances, unnecessary for patients and staff, can be avoided.

The Ear.—Deafness due to wax is best referred to the patient's own practitioner. The wax must be softened by daily instillations before syringing is undertaken. Foreign bodies, if non-vegetable, may be removed by gentle syringing, but vegetable foreign bodies must not be moistened. If simple

usually can be seen by anterior rhinoscopy. This must be drained early to prevent necrosis of the cartilage and these cases must be admitted.

EPISTAXIS in hypertensives, if it does not cease soon after the patient is sat up, may require packing. Use about a yard of half-inch ribbon gauze, moistened with liquid paraffin. Two or three puffs up each nostril from an atomizer containing 1 per cent. cocaine, five minutes before packing, make the pack more tolerable. With adequate lighting pack from above downwards, remembering that the plane of the nasal cavity is in line with the palate, not with the dorsum of the nose. If this is successful and the patient is otherwise fit enough, he may be sent home to his own doctor for removal of the pack after twenty-four hours. He should go to bed for the rest of the day. If packing fails to control the haemorrhage it is necessary to admit the case, to a medical or E.N.T. ward according to circumstances.

In non-hypertensives, sit the patient up, so that the head can be held over a bowl. Get him to plug each anterior naris with a piece of cotton wool and to nip the nose for ten minutes by the clock. Gently remove the cotton wool. If the haemorrhage is less, repeat until it stops. If it is not subsiding the case should be referred at once. Anyone who suffers from repeated epistaxis, even if it has been arrested for the time in the casualty department, should be referred to Out-Patient E.N.T. clinic for further advice.

FOREIGN BODIES in the nose are mostly in children. The essentials for removing a foreign body are good illumination, rigid control of the patient, and a suitable instrument. A good spotlight shining over the shoulder is as good as a headlight and more easily available. Control of a terrified child calls for a precise technique to avoid an uproar. The nurse sits down and holds the child against her chest, the forehead is held firmly against it with the left hand, and the right hand lies across the child's body holding the arms above the elbow. The child's legs are imprisoned between the nurse's knees. A nasal speculum is of little use in a child. A good view of the inside of the nose can be obtained by tilting the tip of the nose upwards with the thumb. A blunt-ended probe, bent almost at right angles for about the last quarter-inch, is the best instrument. It is passed up the nose along the line of the dorsum, above the foreign body if possible. When the tip has passed the foreign body, the probe is swivelled downwards so as to engage behind it and gently pull it forwards. Occasionally angled forceps may be of more use, as, for instance, to grip the edge of a button. If these measures fail the case can be referred to the next E.N.T. clinic with the assurance that there is no danger in leaving the foreign body where it is for the next few days.

The Throat.—The diagnosis of *peritonsillitis* is usually much easier than the decision on disposal. If it has not progressed to pus formation it will usually resolve with intramuscular penicillin therapy, either as an Out-Patient or at home under the patient's own doctor. If admission to hospital is considered advisable the best place for such cases is the isolation hospital. If it

swollen. A discharging furuncle may be seen. If the tympanic membrane can be seen it is probably seen to be normal, though there may be pus or débris on the surface.

Acute external otitis can be adequately treated in the department without reference to the E.N.T. surgeons. Apart from the peculiar difficulties of access, it does not differ from the treatment of boils elsewhere (p. 12). In acute otitis media, if the general condition is good, treatment with antibiotics until the next Out-Patient meeting of the E.N.T. surgeon is acceptable. No local instillations should be made. Where the general condition is unsatisfactory the case should be admitted, and pyrexia is probably the best guide. Acute mastoiditis must be admitted, and whether a confident diagnosis is or is not reached, any case of *a chronic discharging ear complaining of a recent access of acute symptoms* is also a candidate for immediate admission.

Chronic discharge from the ear, whatever its cause, is liable to give rise to an eczema of the skin on the pinna and the adjacent part of the face. The treatment in the first place is designed to stop or reduce the discharge, and to avoid certain local applications, such as antibiotic creams which sometimes make it worse instead of better. It may be proper to refer some cases of otorrhoea to the dermatologist in the first instance, instead of the E.N.T. surgeon.

Earache may, of course, be due to many non-aural conditions, the most important of which are:—

1. Dental abscess.
2. Unerupted wisdom tooth.
3. Oral newgrowth, especially of the tongue.
4. Inflammatory conditions of the tonsils and pharynx.
5. Naso-pharyngeal or hypopharyngeal newgrowth.

The Nose.—INJURIES to the nose are common and many of them appear to require special care. In most the appearance is deceptive. They can be dealt with in the casualty department. Lacerations of the nose, especially those from road accidents or accidents in coal mines, become impregnated with pieces of gravel or coal dust, and proceedings have been taken against surgeons who failed to remove these before suture or dressing. They leave pigmented or " tattoo " marks which may be permanent. They can be teased out with a brush or picked out with a needle or fine forceps; and local infiltration or even general anaesthesia is justifiable in order to do this completely. Bleeding from trauma occasionally calls for packing, but usually abates spontaneously.

If a BROKEN NOSE looks satisfactory (the patient may be lent a mirror so that he can agree) then it does not need any manipulation. If there is asymmetry or other deformity and the injury is an isolated one, arrangements are made to admit for manipulation on the next convenient occasion. Bilateral nasal obstruction following injury may signify a septal haematoma, which

present. If the casualty officer is certain that the case is one of iritis, atropine must be instilled and the patient referred to the eye department at the next clinic. In case of doubt it is best to seek immediate advice.

Other types of inflammation can wait for the next clinic. Ordinary conjunctivitis can be treated in the casualty department with eye drops. The visual acuity is a fair guide to the seriousness of inflammatory conditions.

Corneal ulceration can wait until the next clinic provided atropine is instilled and the eye kept covered with a pad and bandage. The presence of pus cells in the anterior chamber (hypopion) is, however, a sign of virulence of infection and an indication for immediate admission.

Infection of the lids (styes, lid abscesses) can be treated in the casualty department and referred later if the condition does not improve. Blepharitis is usually very resistant to treatment and should be referred to the ophthalmic department.

Injuries to the Eye.—For the casualty room these should be divided into two kinds, intra- and extra-ocular. The former should always and immediately be referred to an eye specialist. It is best to do nothing but put on a soft pad of gauze, cotton wool, and a bandage. The patient must be kept quiet and lying down. Morphia may be given to painful or shocked cases. The patient should be transferred to the eye department on a stretcher, or if transfer to another hospital is necessary it must be by ambulance.

Most of the extra-ocular injuries can be dealt with in the casualty department and referred to the eye department at the next clinic.

FOREIGN BODIES IN THE EYE.—A casualty officer should practice everting the upper lid. The usual place to find a foreign body is under the upper lid, where it sticks in the sulcus subtarsalis. Corneal foreign bodies, especially in people engaged in welding or grinding, are sometimes difficult to remove. There is no harm in trying to do so with a blunt spud after cocainising the eye. Where it is deeply embedded, it is best to refer the case to an eye clinic soon.

Intra-ocular foreign bodies must be admitted at once. It is very easy to miss a small intra-ocular foreign body, even by the very experienced. A history of a tiny blow on the open eye, when using a hammer and chisel, or during some similar occupation, is very suspicious of a penetrating foreign body, even though no immediate disability, no signs, and no symptoms are evident. In case of doubt, the patient should be X-rayed immediately. The sooner an intra-ocular foreign body is dealt with the greater the chance of recovery.

LACERATIONS.—Lacerations of lids or conjunctivae can be treated and sutured in the casualty department, the only exception being lacerations involving the lacrymal canaliculae. These must be repaired by an expert. The conjunctiva will heal well, even without sutures, but the casualty officer should bear in mind that for cosmetic reasons all foreign particles must be

has proceeded to fluctuation it must be opened. Fluctuation can be detected by wedging a tongue depressor vertically between the teeth and palpating the area gently with the forefinger. Incision in the casualty department can be carried out and the case can be returned home for penicillin therapy intramuscularly. A lozenge of Decicain is given and allowed to dissolve in the cheek of the affected side. Adequate illumination over the surgeon's right shoulder is obtained. The patient is given a large dish to absorb his attention as well as to collect the results. The tongue is depressed with a spatula held in one hand, and another tongue depressor may be wedged vertically between the teeth to prevent a bite. If there is much trismus local anaesthetic into the masseter muscle will relax it. An incision is made, where the abscess is most fluctuant, with a No. II blade on a long Bard Parker handle, by a steady thrust posteriorly.

FOREIGN BODIES SWALLOWED by children are usually opaque to X-rays. *Adults usually complain of a meat or fish bone or of a bolus being impacted* somewhere. If there is X-ray evidence of a foreign body anywhere in the pharynx or oesophagus, and there are no obvious signs of distress, the case should be admitted. If there is evidence of dyspnoea the case may be urgent and the E.N.T. surgeon should be informed at once of the admission. This is particularly important if the patient holds his neck stiffly and cannot swallow saliva. Pain located above the collar line usually implies that if the foreign body is there it is in the tonsil or in the posterior surface of the tongue. These areas are examined first under good illumination. If a foreign body is seen it is best removed from these situations with a long pair of Spencer Wells forceps. Meat and large fish bones impacted somewhat lower down *are usually detectable in the lateral X-ray of the cervical region.*

Inflammation of the Eye.—Although injuries are the most usual eye conditions which bring a patient to the casualty department of a general hospital, from time to time patients will report with acute inflammations of sudden onset Unless the casualty officer is able to recognise serious inflammatory conditions he may miss such emergencies as acute glaucoma and imperil his patient's sight by referring him too late.

CONJUNCTIVITIS is the commonest cause of a red eye. GLAUCOMA is the most important. In acute glaucoma the eye is red (sometimes very red and chemosed), the cornea is hazy, the pupil is dilated, fixed and often vertically oval, and vision is markedly impaired. Pain is severe, even to the extent of causing vomiting. The tension is considerably raised as compared with the other eye. The condition is usually monocular. A patient so afflicted should be seen immediately by an ophthalmic surgeon.

ACUTE IRITIS, another important inflammatory lesion, may often simulate a glaucoma, and at times only the expert can differentiate between the two conditions. As a general rule, however, the eye is not hard, and although the cornea is hazy and the eye red, the pupil is small and posterior synechiae are

rule is not serious, and clears up in twenty-four or forty-eight hours. In the severe painful cases it is permissible to use Gutt. Ol. Cocainae 2 per cent., but in milder cases Gutt. Parolein is quite adequate. These cases of "flash" can be treated in the casualty department, but should be referred to the eye department next day, or to the next clinic, for further observation.

Fractures and Dislocations.—A casualty department, as part of a general hospital service, is a haphazard growth. The extent of its functions varies from hospital to hospital, according to the stage of evolution of the other departments; for, generally speaking, the casualty department deals with everything that nobody else wants, and more particularly, deals with everything that nobody else wants admitted. It has, as a result, frequently been required to include the treatment of ambulant bone and joint injuries, and at the present time an intermediate situation is still prevalent whereby the casualty officer reduces such fractures and dislocations, then hands them on to the fracture clinic for subsequent observation and rehabilitation. This is a "Middle Ages" stage of evolution which is unsatisfactory to all concerned. If the casualty surgeon is required to deal with these injuries in the first instance, he should have the time and opportunity to follow them up and share in their subsequent treatment. If the fracture clinic does not accept responsibility for the work in the casualty department, and for the officer there, it should treat all its own cases from the beginning. These problems are at present in process of resolution, and as accident services are provided over ever-increasing areas in the coming years, the treatment of even the simple and "trivial" fractures will be a progressive one, in which care for them will come under one system with one direction.

This section will therefore discuss, not so much the treatment of fractures and dislocations—on which subject it has little new to offer—but rather the handling of such cases as are referred to it in error, through the exigencies of the accident or for other reasons, without it necessarily being assumed that the casualty officer is required to provide any definitive treatment.

It is difficult to draw a line between the cases which should be referred to the fracture clinic and those which may be regarded as "general surgical," or which are suitable for summary disposal. Certain fracture clinics or accident services regard anything with the suspicion of a mishap as within their sphere of influence. Logically this would divide all cases of minor sepsis, for instance, into two quite arbitrary classes—those who cannot remember pricking themselves, and those who can. In most cases, however, a practical division can be attempted, and the casualty surgeon at a general hospital does well if he comes to an early understanding on what the fracture clinic wants to treat.

All such arbitrary divisions into spheres of influence are artificial, and all should be capable of modification in the interests of the individual patient. To transfer a seriously shocked and badly injured man from the casualty

removed, even if this entails excision of some conjunctiva. Conjunctival lacerations extensive enough to indicate suture should be apposed with fine silk on an eyeless needle (such as the Stallard suture), after anaesthesia with cocaine drops. The stitches should be removed in the ophthalmic department. When suturing lids, great care should be exercised in placing the edges in perfect apposition—but this is required of all lacerations, wherever they are found (p. 110).

Abrasions of the cornea, although very painful, are relatively not serious. They can be treated in the casualty room, and referred later to the ophthalmic Out-Patients. Atropine, in cases where there is no danger of glaucoma, should be instilled, and some antiseptic eye drops or Albucid. A pad and bandage should be applied to keep the eye closed.

Contusions following a blow on the eye may have caused intra-ocular haemorrhage or other damage, and it is always wise to seek advice. Here again the visual acuity is a good guide to the seriousness of the condition. Blood in the anterior chamber (hyphaema) is an indication for immediate admission.

Sudden blindness in one eye, an occasional disaster, may be due to a thrombosis of the central artery of the retina. It is occasionally possible to save some of the vision by emergency measures, and the opportunity must not be lost by wrong disposal. *Immediate* personal contact with the eye surgeon is indicated.

Alleged sudden blindness in both eyes is probably hysterical, and if so is usually easily detected, for in spite of alarming behaviour the hysterical patient rarely gets himself into situations where he may be seriously hurt. The totally blind patient with no experience of the affliction is obviously in peril. If there is any doubt these cases also should see the ophthalmologist immediately, as a precaution.

Burns of the Eye.—Burns of the lids not affecting the globe or conjunctiva are treated as other burns (Chapter IX). They need not be referred to an eye specialist unless scarring results when they are healing. Most burns of the conjunctiva or cornea can be treated with any form of ointment or oily preparation and referred to the clinic later, but severe burns of the cornea should be admitted immediately. This applies also to lime burns which, after thorough irrigation with 2 per cent. boracic solution, should be seen soon, their urgency varying directly with the severity of the burn. Certain chemical burns of the eyes come under the same arrangements as for burns and other accidents in the chemical industry. They are discussed later (p. 241).

An arc welding flash burn is a common accident in heavy industry, and gives rise to pain and alarm. It is due to exposure to ultra-violet light by leaving the eye unguarded. It may be mistaken by the patient for a burn from a flake of red hot metal. The onset of pain, photophobia, and lachrymation is often in the middle of the succeeding night, suddenly. The condition as a

1. Excision of wound in the other thigh, with ligature of femoral artery and vein in Hunter's canal, for penetration of both vessels.

2. Laparotomy for (*a*) suture of perforations in the small bowel, with resection of one segment and end-to-end anastomosis; (*b*) exteriorisation of the right half of the colon for extensive laceration of the ascending colon.

The patient survived all these operative procedures. *Fixation of the fracture* was the crucial one. Had they been carried out *in the reverse order* he would almost certainly have died on the table.

How much the treatment of fractures should be carried beyond first aid must vary with other conditions, and particularly with the distance of the casualty department from the fracture clinic. Where the latter is in or near the same hospital no more need be said. The further separated the two places concerned, the more responsibility devolves upon the casualty officer to ensure that transfer will not prejudice the patient's chance of speedy recovery. Apart, therefore, from the outstanding examples of dislocations producing urgent surgical complications, such as the pressure effects already mentioned, other complications or degrees of severity may indicate that he undertakes reduction or other treatment before onward transmission. Reduction of gross displacement or of acutely painful fractures may have to be carried out, in order to obtain adequate fixation, and if it transpires subsequently that such a reduction has been incomplete, and requires further operation, the casualty surgeon need not consider himself to blame. The first reduction may stand on its own merits, and he may reflect for his own comfort that not even the fracture clinics are always entirely successful with the first attempt.

He must also consider the disadvantages of referring fracture cases with open wounds when this entails further delay in the institution of treatment. The early and complete closure of compound fractures is often far more important than early and complete reduction. He may find it necessary to admit to his own hospital for a careful toilet, excision, and accurate suture of the wound itself, even under circumstances when it is unnecessary or impossible to fix the fragments in their optimum position, and even where the orthopaedic surgeon may wish to reopen the wound at a later stage. He may even have to do this toilet himself, in his own department. This procedure stands on its own merits, and may materially improve the patient's prospects of recovery. Early skin cover is as vital to success in this type of wound as in any other. If transport problems and the local organisation militate against it, the casualty surgeon must do what he can to counteract them.

It is usually not necessary to cause further delay by taking pre-operative X-ray plates. Many fractures are obvious at sight, and if primary wound closure is to be attempted the time spent in the X-ray department is a waste of (the patient's) time. A post-operative X-ray will be required, in one department or another, and that plate will serve for the diagnostic evidence now regarded by the Courts as of more importance than the surgeon's opinion.

department of one hospital to that of another because the second has the fracture clinic attached to it may be a grave error (p. 252). It is better to have a live patient in the wrong place than a corpse in the right one. Every casualty department, and every casualty surgeon, should be *prepared* to undertake the resuscitation and early treatment of fractures on occasion, though it may be undesirable as a routine. Until specialisation has achieved the *reductio ad absurdum*, any accident occurring near any hospital is liable to send accident cases into the nearest casualty department, and it is right that every casualty department should be equipped, in material and experience, to deal with them.

It is obviously important that dislocations and fracture-dislocations should be reduced where pressure is being exerted on vessels or nerves. This applies in particular to the elbow and knee. A few minutes may make all the difference between a good result and an amputation for gangrene or paralysis, and a *prompt reduction and splintage, followed if advisable by arrangements for* transfer to the proper clinic, may save a limb. Any case which *really* requires a tourniquet for haemostasis (they are much rarer than the first-aid man has been taught to believe) cannot be sent further without attention to his wound. The effective first-aid treatment of fractures does a great deal to minimise the development of shock and to expedite more precise treatment later in the day. Every casualty department should be equipped to put a leg in a Thomas's splint, to fix an arm or forearm, or to apply a temporary plaster of Paris mould.

Case History

(It is admitted that this case, taken from notes made in a Field Surgical Unit during the late war, is unlikely to be repeated in the experience of a peace-time casualty officer, but it is included to illustrate that the fixation of a fracture is of paramount importance in the relief of surgical shock. When a fractured bone is allowed the small movements incidental to attention to the patient, or to his transport, it produces rapid deterioration in condition, and this is insufficiently realised by those who send the injured unprotected on ambulance journeys.)

A young man suffered multiple penetrating wounds and was received within five minutes of injury. He was already extremely shocked. His systolic blood pressure was about 70 mm. Hg, and his diastolic could not be ascertained with certainty. Three hours' resuscitative measures, including copious blood transfusions, were without effect. His injuries included a compound fracture of the midshaft of the femur.

It was decided to operate between the third and fourth hour. The wound was excised and the femur fixed in a Thomas's splint with skin traction and plaster of Paris over all (the " Tobruk " plaster). As soon as traction was exerted, and while the plaster of Paris was applied, the blood pressure began to rise, and by the time this operation was completed it had returned to 110/70. It remained at this level, and his condition continued to improve, while the following procedures were completed, under the same anaesthetic:—

success by short wave diathermy. Active exercises supervised by the physiotherapist are valuable in restoring mobility, while the short wave treatment is in progress.

Breathing exercises in the elderly who have sustained injury to the thoracic cage (p. 107) reduce the incidence of lung complications. Most cases of painful injury to the back, after elimination from the diagnosis of bony damage and prolapsed disc, may be referred to the physiotherapy department for further treatment.

The staff in the physiotherapy department is probably more closely in touch with rehabilitation services and schemes to restore the disabled than any other part of the hospital, and can give valuable advice on medical tribunals for the Ministries, compensation problems, and other procedures of which the clinician is frequently ill-informed.

Special Accidents in Industry.—Certain areas suffer from special emergencies peculiar to the type of industry carried on, and the experience of Industrial Medical Officers and Medical Officers of Health can be referred to if a series of such is observed. The casualty officer who is a newcomer cannot be expected to have the treatment of these at his fingertips, and even less can he be expected to diagnose cases on sight. Accidents in chemical works are a case in point, and a system is being instituted by which casualties exposed to particular noxious agents are referred to hospital with a label attached to them. It records the particular agent to which they have been exposed, the degree of exposure, the first-aid measures already taken, and the treatment recommended when the case is seen in hospital. The system has been introduced by the Association of British Chemical Manufacturers. Their medical advisers are careful to emphasise that the labels are not intended as *instructions* to be carried out by their hospital colleagues, who are naturally regarded as free to use their own judgment on any case transferred to their care. There need be no misgivings. These injuries are rare, and no casualty officer will receive such advice with anything other than relief. The subject is summarised in the Association's publication, "Gassing Casualties," which has been circulated to all Hospital Management Committees. A copy should be in all the casualty departments in industrial areas.

General Practice.—Many of those treated in casualty departments could be treated as effectively in the surgery of the family doctor. They often attend the hospital without introduction, and it is a matter of local custom whether they are returned to their own practitioner after first attendance or whether treatment is continued until the cure is complete. The practitioner's attitude to such attendances varies, but corresponds closely with the variety of reactions to the issue of certificates by the hospital officer (p. 207). Where it is known that the practitioner has a strong preference, the casualty department should indulge it. Out-Patient hospital services should be complementary to general practice, not rivals to it.

Where a fracture obviously stands in need of treatment, therefore, there is no legal necessity for X-ray examination.

The X-ray examination of other cases, in particular of closed fractures, also depends very considerably on circumstances. A fracture which can be diagnosed on sight will gain nothing by being sent through the radiological department if it is intended to refer it elsewhere. This view is unfortunately not shared by all orthopaedic departments, some of which demand X-ray evidence before they accept the case for treatment; but unless such a condition has been laid down, it is better that the case should have its X-ray plates taken in the place that treats it, and prompt transfer with adequate splintage is the proper procedure.

The casualty department should therefore use radiography particularly for diagnosis of doubtful cases, and in fact, whether it does so or not, the majority of its films will be for the purpose of showing that there is no fracture rather than of showing that there is one. X-ray examination must be carried out at some stage in all cases where the *possibility* of a fracture exists—not only in those where a fracture may reasonably be expected—unless the opportunity is to be afforded by operation for direct inspection of the bone concerned (p 117). Five per cent. or more of all cases coming to a casualty department are sent in order to obtain X-ray evidence that no fracture is present, and if this evidence is obtained there may be no necessity to refer the patient anywhere else than back home.

Physiotherapy.—The physiotherapy department may be under the direction of the orthopaedic surgeons, or of a medical man specially appointed for the purpose. In either case, it should be possible for a proportion of its activity to be devoted to casualty cases. The casualty surgeon should follow them into the physiotherapy department, or arrange for them to be seen by him from time to time for their progress to be observed. If he uses it for disposal of unwanted or unsuccessful cases, and then forgets them, he cannot expect enthusiastic cooperation from the physiotherapists. If he concentrates from the beginning on restoration of function (p. 69) as well as on surgical treatment, he will have relatively few cases for which expert physiotherapy is necessary. These few will profit from it proportionately.

Early reference of some examples of the tropho-neuroses (p. 218) for physiotherapy may be successful, whereas physiotherapy in the later stages, without most careful supervision, may fail to relieve, or even may aggravate the condition. Early reference of periarticular injuries to the shoulder is also profitable. The rôle played by physiotherapy in treatment of the sprained ankle has also been discussed (p. 108). The use of physiotherapy in most acute septic conditions has ceased to be important. Baths and local heat are much less necessary than they used to be. Nevertheless, some cases of " balanced " sepsis, in which antibiotic therapy has prevented spread of infection, but which has resulted in a hard, brawny swelling slow to resolve, may be treated with

success by short wave diathermy. Active exercises supervised by the physiotherapist are valuable in restoring mobility, while the short wave treatment is in progress.

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A large group of cases is referred by the general practitioner because he considers they require facilities beyond his means, such as sterile dressings, instruments and operating techniques. When the need for these is past, the patient may be returned to him for further treatment. Thus, a patient attends *with a lacerated wound, which needs suture under anaesthesia.* The casualty department carries out the suture, and returns the case to the practitioner for further dressings and removal of sutures at the proper time. If sepsis supervenes, the practitioner may return the case for further treatment. This is a well-recognised and perfectly legitimate division of responsibility between two parts of the medical service, but it has the following disadvantages:—

1. *Any* division of responsibility tends to reduce efficiency.
2. *The casualty department does not have the satisfaction of seeing its* end results, and of profiting by its errors.
3. The practitioner may be faced with dressing procedures without proper aseptic facilities, and it is probable that the sepsis rate is higher with this arrangement than when all dressings are done in the hospital.
4. There is more delay in treating complications or relapses because the practitioner is not unnaturally disinclined to send his patient up to hospital a second time.

It is, however, a useful policy to adopt in certain cases, particularly those coming in from outlying districts (p. 43), and a commonsense approach is called for to avoid many patients travelling long distances merely to receive a simple dressing, an injection, or a piece of obvious advice. For most cases, however, and especially those which have had minor operations, it is preferable to continue treatment until the case is cured, and to continue the responsibility until the patient is within a day or two of return to work. Only in this way will an efficient method of treatment be laid down for the department.

From the nature of their complaints, a high proportion (up to 45 per cent.) of cases only attend once, for the removal of superficial foreign bodies, advice, reassurance, abrasions, and so on. An analysis of the main reasons for a single attendance is given in an Appendix (Appendix I).

Most of these should be told to inform their family doctor that they have attended, and what was said and done. If the practitioner has himself referred them to the department with a note, a letter should be written. Most hospitals cannot face the administrative cost of correspondence on every casualty case, and selection in this matter calls for discrimination. Cases referred with the specific object of obtaining X-ray evidence of the absence of bone injury (p. 240) should take back a note of the X-ray findings, and not merely be informed that "everything is all right." The more letters the casualty officer can find time to write, or the more clerical assistance he can find to write them, the better will be the help he can give the family doctor.

Relations with practitioners referring cases for emergency admission vary from area to area and from practice to practice. Many practitioners still ring

up the receiving officer and discuss the case as well as its admission. Many areas have a bed bureau system which endeavours to find accommodation for urgent cases. It may or may not be used by the practitioners, and even in areas with efficient systems direct contact between practitioner and the ambulance service may produce emergencies in the receiving room quite unheralded. Street emergencies are usually brought to the nearest hospital, and may have to be sent elsewhere (pp. 227 and 239).

There is bound to be an underlying divergence of impulses between the practitioner and the hospital officer, for the former's object is to get the patient into hospital, and the latter's is to balance its probable degree of urgency against all the other cases from all the other practices which press upon a limited number of beds. Even these responsibilities, however, seldom outweigh the disadvantage that he has *not* seen the case when the practitioner *has*. A barrage of telephonic resistance against the reception of emergency cases is the surest way to bring disrepute upon the receiving room.

The casualty officer is either one who will be in practice himself (possibly in the neighbourhood) or one who will achieve higher position in the hospital service (possibly in the same hospital). In either case, cooperation with the practices in the area, and a close liaison with them (apart from improving the standard of service which both can maintain) are in his own interest as well as that of the patient.

Frequent contact between the casualty department and the surrounding general practitioners has a further advantage. Many of the cases submitted for minor surgery, and especially the cases of minor sepsis, suffer unnecessary prolongation of their disability because opportunity to operate is given later than it need be. Delay in attending the department is one of the principle causes of bad results. It is responsible for many cases of spread to bones and tendons, and for unnecessary necrosis of skin which takes many days to heal and which may require skin grafting. In one series almost 20 per cent. of cases of pulp space infection gave a definite history that the patient attended some other doctor for treatment early in the disease. Palliative treatment, penicillin injections, and other measures were continued after suppuration was established. It is probable that this figure falls far short of the average. Only by making his surgical views known in the " outside world " can the casualty surgeon do anything to reduce it.

On the other hand, if it is expected that every case is referred to the casualty department as soon as a finger is pricked or a spot appears, not only will it be overwhelmed in a short period, but it will as rapidly lose the confidence of the area. The proper resort in the first instance for all cases other than emergencies is the family doctor, and the casualty officer must have an answer ready when he is asked to define the stage at which the family doctor should send them on to him.

A large group of cases is referred by the general practitioner because he considers they require facilities beyond his means, such as sterile dressings, instruments and operating techniques. When the need for these is past, the patient may be returned to him for further treatment. Thus, a patient attends with a lacerated wound, which needs suture under anaesthesia. The casualty department carries out the suture, and returns the case to the practitioner for further dressings and removal of sutures at the proper time. If sepsis supervenes, the practitioner may return the case for further treatment. This is a well-recognised and perfectly legitimate division of responsibility between two parts of the medical service, but it has the following disadvantages:—

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(and where to admit if he does) can be supported either by a senior resident or a consultant. The higher his own status the less will this be necessary, and it must be remembered that frequent or frivolous resort to this advice not only reduces confidence in the casualty officer himself, but creates congestion and delay in his own department while examination rooms are occupied by patients awaiting the second opinion. On proper occasions, however, he should not hesitate to request this support, and it is probable that the responsibilities of the senior staff towards casualty work will be considerably increased as its importance becomes more generally recognised.

Reference

ROWBOTHAM, G. F. (1949). "Acute Injuries of the Head." 3rd ed E. & S. Livingstone.

Over 50 per cent. of staphylococcal infections seen in general practice within two or three days of onset will resolve without suppuration if treated with adequate doses of penicillin and absolute rest to the part. A reasonable division of responsibility between those who try to obtain this resolution, and those who have to resort to surgical intervention as well, can be established

The patient reports to his family doctor an inflammatory lesion which threatens to incapacitate him. The part is put at rest (e.g., by splint, or sling, or by confining him to bed), an adequate dose of penicillin is given *by injection,* and the patient is seen again the next day either in the surgery or by visit according to the situation of the lesion. If there has been subjective improvement—that is, reduction in pain—the treatment is continued and the injection repeated. Pain severe enough to interfere with sleep is a danger sign. If the pain is increased and the inflammation is spreading it is improbable that penicillin and rest alone will be effective. It has already been emphasised that the majority of acute inflammatory lesions in general practice which fail to respond to penicillin are unlikely to respond to other antibiotics, and that the failure is due to other factors than bacteriological resistance (Chapter I). Such cases, therefore, may be selected as early as the second day of treatment, and it is highly improbable that those which withstand adequate penicillin dosage for as long as *three* days will abort however long the penicillin is continued.

As long, therefore, as subjective and objective improvement is maintained (and the former is often as good a guide as the latter) it is unlikely that the case should be referred. Many of these resolve entirely, and a few form a superficial subcuticular collection which can safely be evacuated in the doctor's surgery with a pair of scissors.

All those whose pain persists more than forty-eight hours under adequate treatment are liable to require formal surgery, under adequate anaesthesia, with full aseptic precautions The heroic stab under ethyl chloride spray is quite outmoded Continuing treatment by running through the list of antibiotics *seriatim* may appear to be very advanced, but it shows a failure to grasp the principles upon which their effect is based. (Over half the cases coming to the casualty department which have had palliative treatment for six days or more, with or without antibiotics, suffer skin necrosis or other secondary complications.)

Between the second and third day, therefore, is usually the dividing line. If at this time the case is obviously improving, the practitioner can expect rapid success. If it is not, he needs the assistance of the hospital.

Consultants.—Apart from the special departments whose views on admission and reference of cases have already been outlined—E N.T. (p. 230), Skins (p. 74), Eyes (p. 234), Orthopaedic (p. 237), and Neurosurgery (p. 225) —it is becoming more advisable than previously that the casualty officer should have an understanding whereby his decision to send home or admit

decisions, and where he may think that the reasons for making those decisions could be of interest to the Court.

The second part of the casualty officer's evidence is evidence of opinion, and here he should be very careful. He should clearly understand the difference between his own position and that of the "expert witness." The expert witness is generally one who has no personal knowledge of the case, or whose knowledge in this respect is acquired by examination some time after the event. His value to the Court is by virtue of his experience of a number of similar cases, and of his learning on the pertinent medical subjects. He is called by one or other side in the contention because that side believes his views will aid their case. Expert witnesses are occasionally called to the Court of Summary Jurisdiction, but the majority of cases dealt with there do not need such a course, and the medical evidence is not usually such as will materially affect the legal findings.

The casualty officer who has treated the medical condition associated with magistrates' legal procedures is of value mainly from his evidence of fact, but he may legitimately be asked by the Court to assist them with his general medical knowledge. He should remember, however, that his opinions may sometimes be carried with the case into the County Court or the Court of Assize, and in this event they may come up against some formidable and well-informed criticism. He is well advised, therefore, not to offer an opinion unless it is asked, and when asked, to be careful to state that it is *his* opinion. On occasion it is best to admit frankly that his experience is inadequate to give any help upon which the Court can rely. He will lose nothing by this last resort. The Court can expect him to remember facts. It cannot and does not expect him to be wiser than his years.

In a case where medical science offers no clear answer or where there is wide divergence of view amongst medical experts, the casualty officer will do well to say so, rather than to express a dogmatic opinion.

Nothing causes more legitimate annoyance in a Court than the young doctor who expounds his views with abstruse medical terms in the hope of impressing with his learning. His evidence should be couched in ordinary language—the inguinal region is the "groin," the orbit is the "eye socket," the submental region is "under the chin," and so on. He loses nothing by being understandable. On the other hand, he can create an almost equally unhappy effect by labouring the obvious. Everyone of average experience knows what pneumonia is, or a heart attack, or a stroke. An elaborate explanation of such conditions not only wastes the time of the Court but gives an impression of condescension which ill befits a young doctor addressing an assembly of the worldly-wise.

Whoever calls him, in effect he appears neither for defence nor prosecution, and he should remain perfectly impartial, whether his erstwhile patient is culpable or not. He should give his evidence precisely, without bias, even

CHAPTER XV

LEGAL RESPONSIBILITIES

THE casualty officer deals with more cases in which the Law is interested than any other hospital officer. He is more often required to give evidence or to make statements to the Police, and he is more often brought into contact with H.M. Coroner. He may be acutely conscious of his ignorance of the Law, and may approach this part of his responsibilities with trepidation. He is apt, as a result, to suspect that his every appearance in Court will afford an opportunity for overbearing legal experts to confound his evidence and destroy his dignity Nothing could be further from the truth. He will almost invariably be listened to with courtesy and respect. Provided that he has handled his medical case with average conscientiousness this will be made manifest in the course of the legal proceedings. The doctor is not on trial, and as long as he avoids the impression of being on the defensive, no one is likely to imply that he is. With very rare exceptions, he may rely on the Court to place any protests or criticisms from witnesses antagonistic to him in their proper perspective.

This chapter is concerned with situations in which it is unlikely that his handling of the case, or the efficiency or organisation of the hospital authority which employs him, is in question. A discussion of all situations in which the possibility exists of a medical error, or of other circumstances in which he may be open to criticism, is deferred to the next.

Court of Summary Jurisdiction.—This is the " Police " Court, or Magistrates' Court, and it deals with approximately 90 per cent. of offences and crimes occurring in this country. It refers the more serious ones to higher Courts. The casualty officer may be called to give evidence in this Court, and in the majority of cases he will find his duty a straightforward one. He will describe the circumstances in which he is concerned with the case, and the medical condition which occurred, and sometimes will be required to report his disposal of the patient. The evidence required of him is divided into two parts, and he must distinguish clearly in his own mind into which part falls any particular piece of it. Firstly, he is a witness to fact. He may also have heard certain statements, by the patient or those accompanying him. But, as a general rule, he will not give evidence of happenings which were described to him (hearsay evidence) unless he is specifically requested, and unless the suggestion is made to him in such a way that he can answer simply—thus—" Were you told he had been knocked down by a car? " There may be exceptions to this, as for instance, where hearsay evidence (such as of transient unconsciousness) may have influenced his medical

to the implication is all that is required, and the subject will then in all probability be pursued no further. Such questions are deliberately raised by the Coroner in order that the negative shall be recorded. The medical witness will spoil his effect if he "protests too much."

Most Coroners are sympathetic towards practitioners, and perhaps surgeons in particular, as experience has demonstrated the responsibilities they must shoulder. In the large majority of cases it is the object of the Coroner to satisfy the relatives that nothing has been left undone that could reasonably have been foreseen, and that the operative procedure, other form of treatment, or line of action was imperative.

The Police Case.—The recent extension of the ambulance services, and a tendency to their centralisation under Hospital Management Committees or the Public Health Service, have resulted in a diminution of the responsibilities of the Police Force in bringing cases to the hospital. Most calls for an ambulance (on a 999 system) now go direct to the hospital ambulance service, whereas previously the Police ambulance, usually manned by the Fire Service, dealt with all street accidents, and many of the industrial accidents as well. A Police officer who has taken charge of an accident or the results of a crime may still, and usually does, call the Police ambulance, or if he uses the hospital ambulance service he will come to hospital with the case and expect to be informed of its subsequent progress. The situation does arise nowadays, however, in which the victim of a crime, or a criminal, is brought into hospital by the hospital ambulance before the Police are informed, and the patient is closely followed by a Police officer trying to catch up with his case. It may be that the casualty officer is the first person in any position of authority to be made aware that a crime has been committed, and under such circumstances the Police almost invariably adopt the view that it is his duty to inform them and to initiate investigations. *He must not necessarily assume that the Police are right.*

CASE HISTORY

An elderly woman was sent into hospital as a case of severe rectal haemorrhage "needing blood transfusion." She was admitted and transfused. In the course of taking a history it transpired that she had been kicked in the back by her husband five days previously. A diagnosis was made of retro-peritoneal haematoma pointing into the large bowel, and conservative treatment on this assumption resulted in a satisfactory recovery. The patient's daughter wrote to relatives elsewhere of the circumstances of the injury, and the relatives informed their local Police. The Police Force in the patient's town were then informed by the more distant Division, and the house surgeon was reprimanded by them for failing to report a suspected crime.

This is an occasion on which the Police and the medical profession have adopted opposed views. If the relatives, or the patient, wish to make a complaint, it is proper for them to do so. It is *not* part of the doctor's duty to take the initiative.

though some parts of it may point in one legal direction and others in the opposite. For these reasons also his resort to his own opinions should be as infrequent as possible.

In return for a balanced medical approach to the case, the Court can be expected to assume his ignorance of legal procedure. He is entitled to appeal to the presiding authority at any time in his evidence if he does not understand what is happening; yet his evidence will lose much of its value, and he will lose much of the respect due to his professional position, if it becomes apparent that what he is saying is unduly influenced by its possible effect on the outcome of the case. He should, in particular, avoid all comments or opinions which might reflect on the behaviour or the motives of any of his colleagues.

The Coroner's Court.—The Coroner is concerned to establish the cause of a death which has occurred under certain circumstances. The reader is referred to works on forensic medicine for the full scope of the Coroner's responsibilities (and to p. 263), but it must be advised here that if there is any doubt the Coroner's Officer should be informed, and the decision whether to hold an inquest or not rests with the Coroner himself. The Coroner must satisfy himself—and no one else—of the cause of death, and consequently there is very great variation, from time to time and from place to place, in the conditions that will cause an inquest to be held (p. 256). This variation bears no relationship to the views of the medical officer, and he is always on the safe side if he reports. He is under no legal obligation to do so, but his cooperation is generally expected, and if he falls in with the Coroner's views in these matters he is more likely to meet a sympathetic atmosphere in Court than if he stands upon the letter of the Law.

In general, the remarks made upon the procedure in the Court of *Summary Jurisdiction, in so far as they concern the giving of evidence by* the casualty officer, apply to that in the Coroner's Court. Hearsay evidence, however, is admissible in the Coroner's Court, and it is left to the Coroner himself to assess its value.

In this Court questions upon the medical or administrative handling of a case are more frequent, and it must be emphasised at the outset that if the Coroner's Officer informs him, or if he infers from statements by relatives, or indeed, if he suspects by any means whatever that his professional reputation is likely to be impugned at the inquest, he should communicate with his medical defence organisation at the earliest opportunity. He should not make any statement to the Coroner's Officer before he does so, and he should not wait until the inquest to "see how things go."

In many cases it is in the doctor's interest that an inquest should be held, and that any doubts about his conduct of the case are resolved in public. Questions at an inquest are often put in such a way that the over-apprehensive *doctor may sense suspicion or criticism. A decided negative*

should be obtained, from him, in the presence of witnesses, before any statement on his condition is submitted.

Much embarrassment on the subject of privilege can be avoided if the casualty officer does not show too much curiosity about the manner in which his patients receive their injuries. His questions should be confined to such as are necessary for a proper diagnosis. If the patient wishes to make him a confidant, and offers further information, he cannot be blamed for listening, but it is advisable to give the warning that any confidence may have to be disclosed in Court. If the patient wishes for Police action, the doctor's course is clear. A patient may not necessarily wish for it even if it is justified. Husbands, wives and other relatives often find their affection stronger than their desire for justice.

At least one large hospital has arranged for a Police officer to be on duty in an annexe. He is constantly in communication with his Division. There are such frequent contacts with the Police that this system may prove economical both to the Force and the hospital. It relieves the casualty officer of much work and responsibility in these cases. On the other hand, it is undesirable that casualty departments themselves should be a frequent resort of Police constables, or that they should regard them as a place where they can prosecute their enquiries. The casualty officer should meet them there as privately as possible, and should not agree to prolonged interrogation of patients or patients' relatives unless there is a good and urgent reason why it should not be done elsewhere.

Case History

The casualty officer arrived in his department to find a patient who had sustained a minor scalp wound the previous night. A P.C. was waiting in the corridor outside. The casualty officer announced that he would see the patient at once and, if the Police were interested in the case, he would see the constable immediately afterwards. It was clear that the constable's interest was in the patient and not the doctor, for he promptly disappeared.

The casualty officer's responsibilities towards most Police cases are discharged by submission of a "statement." As he will omit all hearsay evidence, and usually all evidence of opinion (unless he is specifically asked his opinion of a particular point) there is seldom any ethical reason why he should not provide it. It is the writer's view that it is unnecessarily unco-operative to refuse to give statements to the Police on the majority of cases, provided permission is obtained from the patient (and this is usually readily given). The statement should be governed by the principles already described, and then it is unlikely that any breach of professional duty will be committed. If the patient is unconscious, permission cannot, of course, be given. A bare statement of facts to which he cannot raise objection later is all that should be supplied.

Information confided to the doctor in the course of his professional duties is privileged. He is under an obligation of professional secrecy not to divulge it to any third party—lawyers, police or anyone else, without the consent of the patient. This responsibility overrides his responsibility as a citizen to assist the maintenance of law and order, except under certain clearly established circumstances.

1. Certain regulations and statutes require the medical man to report notifiable diseases, industrial diseases, and the existence of "carriers" (e.g. typhoid) whether the patient approves of the notification or not.

2. Privileged knowledge must be divulged when a Court orders the witness to do so. When asked a question which can only be answered by betraying a professional confidence, the medical witness should decline to answer, giving his reason. If he is then pressed, he appeals to the presiding authority. If the Court directs that he should answer, he will.

The *manner* in which he maintains this attitude will do much to determine whether he gives the impression of being awkward and uncooperative, or of being correct in a detail of procedure which the Court understands as well as or better than he does himself.

3. Certain occasions will test his conscience as a citizen more than his responsibilities as a doctor, and on these no one can advise him. The writer, for instance, would have no hesitation in betraying a privileged communication if it led to the apprehension of a criminal lunatic, whereas a similar situation with regard to a minor offence would be governed by professional principles; but this is an article of faith, and the individual doctor must make his own decisions.

Nevertheless, it is as well to point out the penalties for any gross divergence from the usually accepted views on this point. If he refuses to reveal a privileged communication when expressly ordered by the Court, he may be committed for contempt of Court. If he reveals privileged communications when the majority of his colleagues would regard the circumstances as failing to justify it, it would be possible for him to be subjected to disciplinary measures by the General Medical Council. He will take these horns of a dilemma into consideration when making his decision.

The authority of the Courts does not extend to the Police. They are not entitled to command the divulgence of privileged communications, nor of any information obtained in the course of examination or treatment of the patient.

From time to time casualty departments receive notification of descriptions of "wanted" individuals, who have suffered some injury as a result of their crimes, and who may attend hospital for dressings. The Ethical Committee of the B.M.A. adopts the view that the doctor has no obligation to assist the Police in these circumstances.

No patient, whether suspected of a crime or not, can be medically examined against his will, and in the type of case under discussion permission

author is not aware of any occasion on which a casualty department has been called upon to do so. The casualty officer is under no legal obligation either to urge the patient to make a statement or, if she refuses to do so, to take any further action.

On the other hand, if the patient about to die expresses a wish to "clear her conscience," and if she regards the exposure of an abortionist as part of this process, the doctor's course is obvious. It is better that a death under these circumstances, like most deaths in a casualty department, should be reported to the Coroner (p. 256), though a death certificate may be issued if the casualty officer wishes to do so. The Coroner's Court will decide if Police action is indicated. The casualty officer, when approached on his association with such a case, should confine his statement to facts. It is as well to remember also that the majority of abortions are *not* criminal, and that not all stories told by the patient are strictly true.

Cases Brought in Dead.—It is advised that these also are reported to the Coroner, whether the Police inform him or not. The Coroner makes an order on post-mortem examinations if he requires them, and they are now almost always carried out by a pathologist. The casualty officer's statement should follow the principles on these communications which have already been laid down (p. 251).

Suicide.

CASE HISTORY

A case brought to the casualty department was diagnosed as suffering from barbiturate poisoning. The doctor made his diagnosis on the basis of information —a confession—made to him by the patient in the course of his examination. The Police applied to him for a statement, which he refused to give. In Court the Police, who were prosecuting, protested against his refusal to supply the information "because it is most important that we have it." The doctor said he would give information "if the Court insists" The Chairman said "We do not insist, we request it." The doctor said he would then give it if the patient gave him permission. The patient pleaded guilty and gave permission for the doctor to speak. The doctor then gave the diagnosis

The doctor's behaviour was perfectly correct. He might, perhaps, have supplied a statement to the Police without including any privileged communications. It might have improved the atmosphere. Nevertheless, the doctor does not lose his privilege until he is in Court and is commanded to divulge his information.

Many cases of attempted or successful suicide are known to the Police by the time they are brought to hospital. Of those that are not, admission for the medical or surgical condition is usually indicated, and the casualty officer does not need to make a decision. Very occasionally, however, the casualty officer finds himself in a responsible position in this connection.

The Police are usually well satisfied with this simple procedure and it may (and usually does) reduce the probability that he will be called to Court to give evidence. He should, however, elect to give his statement in writing, and if necessary postpone it until it can be prepared as a document. He should keep a copy himself, and it is advisable to file another with the case records. He should not dictate his statement without being able to retain a precise record of what he has said. It often sounds very odd when it is reproduced in Court through the medium of a policeman's notebook. Any notes he makes at the time, and his own copy of the statement he has made to the Police, may be taken into Court to refresh his memory.

If the patient insists that the doctor makes no statement whatever to the Police, the casualty officer will reply to the Police request that the patient refuses to allow him to give any information, and that consequently he is governed by his undertaking to professional secrecy. The Police must then proceed to call him to Court for the information to be obtained.

Inebriation.—The casualty department of general hospitals should not be used by the Police to provide a diagnosis of inebriation. This is the duty of the Police surgeon or of a general practitioner, and the place for it is the Police Station. On the other hand, inebriation associated with a medical or surgical emergency, or inebriation as a medical emergency itself (p. 229) must be considered with great care. This problem has been discussed from the medical viewpoint, but it must be afforded some sympathy from the Police point of view as well. It is better that a number of inebriates should pass a more comfortable night (in hospital) than they deserve, than that a cerebral catastrophe should lie untreated in a Police cell.

Transfer of Cases to Special Hospitals.—The clinical aspects of transferring casualty cases (such as fractures) to special hospitals has been dealt with at some length in Chapter XIV. The legal aspect of such decisions may be referred to here. Most Coroners are well aware of the advantages of such cases being sent where they are most likely to get specialised treatment. But many relatives protest at such transfers, and a Coroner may find great difficulty in finding justification for these moves in face of such a protest. The casualty officer must show that he has taken care to ensure that the patient is fit to travel, and he should avoid transfer of the moribund. He should also override any other administrative arrangements which would give rise to similar protests—such, for instance, as the transfer of seriously ill persons to another hospital because his own was not on an official receiving rota for the day.

Criminal Abortion.—It is only on the very rare occasions when a death occurs in the casualty department, or in the casualty receiving ward, that the casualty officer may be required to take action in these cases. It is usual to advise that attempts should be made to obtain a dying declaration, but the

Cases requiring urgent psychiatric attention can be referred on a temporary certificate, a voluntary certificate, or a "three-day order" by application to the "duly authorised officer." Contact with the "D.A.O." can be made through the Medical Officer of Health. Whatever course is adopted, it is most satisfactory to consult with the physician at the mental hospital. His recommendation and advice on how to go about it should be followed, to avoid making a decision in the casualty department itself.

This is a further example of a divergence of duties between the medical and legal professions. The doctor regards his duty to his patient as higher than his duty as a citizen, unless he is clearly faced with a situation in which his duty to his patient runs counter to his duty to the community as a whole *(p 250). Attempts to commit suicide seldom threaten the community.*

Death from Anaesthesia.—This disaster is still, and probably will remain, one of the most upsetting experiences of any surgeon, and the casualty officer and junior anaesthetist faced with it labour under a great sense of responsibility. The anaesthetic and surgical aspects have been discussed in Chapter XI. Care in administration and choice of anaesthetics will reduce its incidence. The insistence on admission of any case about which the anaesthetist does not feel confident will reduce it still further. The few cases which remain are almost all attributable to unanticipated misfortunes, and they also have already been enumerated.

When everything medical and surgical has been done, it is essential to record the facts, the case history, the resuscitative measures taken, and the times of the salient events. The surgeon and anaesthetist should proceed *at once* to establish their points of agreement, and to record them. They should emphasise in their records that adequate measures were taken in the pre-operative, operative, and critical stages. The administration of injections such as coramine, camphor in oil, adrenalin—under certain conditions only (p. 185)—or nikethamide should be recorded. Any doubts they may have as individuals about the efficacy of these substances are not pertinent to the records. It is their object to show that *everything possible* was done.

It is important also for junior officers to show that attempts were made to obtain further skilled help, and the casualty staff should report the events to the senior medical staff as well as to the Coroner.

The third important point is to show that resuscitative measures were not only given, but were readily available, and it is in this connection that a record of the times of the events becomes so significant.

It is usual for the anaesthetist to be called to the inquest, but the surgeon may be called, or both. A manifest willingness to assist the Coroner in his enquiry will go a long way towards lightening the doctor's anxiety. There is no established method of eliminating the danger of death under anaesthesia. All that is possible is to continue to improve methods of reducing its incidence,

Case History

A woman sent in by the family doctor as a case of coma recovered consciousness in the ambulance and in the casualty department showed no signs of illness. A full medical examination was carried out. The history obtained from relatives was that one and a half capsules of "seconal" had been taken and the patient had been difficult to rouse. This dose was not regarded as likely to have any dangerous sequelae and the case was returned home to the care of her own doctor. Later in the same evening she took a large overdose of the same capsules and it proved fatal. Criticism of the casualty officer (though not in Court) arose because he had not admitted the case to prevent a second attempt.

There was no reasonable basis for the criticism.

Most medical men adopt the view that an unsuccessful attempt to commit suicide is not a case in which they should make efforts to call down punishment on the patient. On the other hand, it may be necessary to put restraint of some kind on the patient for a period of time for his own protection. Attempted suicide is a criminal offence and is frequently followed by a Police charge. Successfully accomplished suicide, on the other hand, almost invariably results in a Coroner's verdict in which the deceased is excused by a reference to his mental instability at the time of the act. Attempted suicide should therefore logically be an indication for psychiatric treatment, not a Police charge, and all such cases should be treated at a mental hospital, unless the medical or surgical condition is such that general hospital admission is necessary.

This is not yet the usual procedure, and cases of attempted suicide who do not require admission for their organic lesions often call for a decision on disposal. Much depends on the circumstances, and particularly the emotional state of the patient. Young girls who make a half-hearted attempt to commit suicide because they have misbehaved and missed a period may often be returned to the vigilance of their parents, and the parents are eager to accept the responsibility provided no further action is threatened. It is *not* the doctor's duty to inform the Police.

Acute depression, melancholia, anxiety neurosis and other psychiatric abnormalities with associated suicidal tendences are indications for admission to a mental hospital, and if the casualty officer can show that he has attempted to arrange admission he should be immune from any consequences if the patient cannot be admitted. Here again he should not take the initiative in calling the Police.

In some areas there is already a standing arrangement with the Mental Hospital Service that any case of attempted suicide which does not merit admission to general wards can immediately be referred by ambulance to the nearest mental hospital. There the physician on duty will assess the situation, and if he considers it reasonable to return the patient to the care of relatives he will allow it.

attitude on the part of the casualty officer. If, at the same time, the casualty officer remembers that his own responsibility to his patients is deserving of respect, the Law will respect it.

Law, Medicine and the Church are professions with a very high sense of service. The experiences of any one of them give a penetrating insight into the ethics of the other two.

REFERENCES

For the doctor's position in cases of attempted suicide,
THWAITES, J. C. (1952). *Brit. med. J.* I, 657.
The first case history in the section on suicide is described in *Lancet* (1952) ii, 824.
For submission of evidence in Court,
FORBES, R. (1947). "The Medical Witness" (report of a lecture). *Brit. med. J.* ii, 969.
For the diagnosis of inebriation,
HARTLEY, A. E. M. (1953). *Brit. med. J.* i, 735.
See also,
GLAISTER, J (1953). "Medical Jurisprudence and Toxicology," 9th ed. E. & S. Livingstone.

and to ensure that the doctors and the hospital concerned are well prepared and equipped to deal with the emergency. The Law is well aware of this.

There is variation in the conditions under which an inquest will be held. The majority of Coroners expect notice of deaths occurring before the patient recovers "from the effects of the anaesthetic." This allows a certain latitude of interpretation under modern conditions, when it may be difficult to determine which component of the various anaesthetic mixtures is the one concerned. If, however, anaesthesia in the casualty department follows the recommendations made in Chapter XI, the point at which the patient may be regarded as recovered from the anaesthetic is fairly clear-cut, and corresponds with the return of rational behaviour and intelligent response to commands Even then, it is wise to report all cases where there may be some doubt, and in the casualty department any death occurring before the patient leaves for home should be reported, whether the patient has technically "recovered" from his anaesthetic or not.

Some require notice of all deaths occurring within twenty-four hours of the administration Some require notice of deaths "in the operating theatre." Under this condition the temptation to accelerate the patient's admission to a ward must be firmly resisted. As long as there is a prospect that resuscitation will succeed, the patient must be kept where the resuscitative measures are most readily available and most easily applicable—that is, in the theatre. The possibility of "escaping" an inquest by even the slightest increase in risk to the patient cannot be entertained. The Coroner himself will be the first to appreciate this attitude

It is believed that the proper test as to whether a case should be reported to the Coroner or not is as to whether death has been *accelerated* by the administration of an anaesthetic or the performance of an operation. Deaths under anaesthesia in a casualty department will almost always come within this definition

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It has been necessary in this chapter to discuss a number of circumstances in which the doctor's care for his patient may seem to run counter to the efforts of the Local Authority to maintain law and order. Any impression that such is the doctor's everyday attitude to the Police is a false one, and the casualty officer will do all that he can to avoid sustaining it. The relationship between the medical services, the local constabulary, and the legal profession has almost always and almost invariably been a very happy one. This is as it should be. Those who have seen a casualty department, late at night, invaded by unruly, drunken patients and their relatives will have seen many occasions when the Police cheerfully and willingly assist the hospital in maintaining order. Without their presence, in fact, medical work under these conditions would often become impossible. It would be a poor return if the constable's report at his station is made more difficult by an uncooperative

protracted argument afterwards. A simple explanation of the reasons for undertaking operation or requiring a general anaesthetic may be enough. A reserved attitude when giving any prognosis is a wise precaution, though it should never be carried to the extreme of gloomily exaggerating the gravity of the condition only to gain *kudos* if treatment is successful.

Permission for anaesthesia and for the performance of an operation must be obtained in writing beforehand (p. 182). The nature of the operation should be explained in simple terms, and that is a responsibility which should not be delegated to someone else. If an amputation is involved it must be stated, and if possible, the site of the amputation should be indicated. On some occasions one announces that the operation may prove to be an amputation though one intends to " save " the member if it is possible. Throughout this book the emphasis has been on conservation, and it may be better to conserve a member, and allow the patient to realise by later experience that amputation is necessary, than to demand early amputation when the patient is unwilling to accept it.

Case History

An eleven-year-old girl was brought by her father to the casualty department. Eight weeks previously a lacerated little finger had been treated elsewhere, and a very belated diagnosis of cut flexor tendons at the metacarpo-phalangeal joint had been made.

The father demanded a precise and detailed prognosis before further operation was accepted. The surgeon wisely refused to give one. He pointed out that in his opinion the finger was at present useless, and in the way. The hand as a whole would benefit by amputation of the finger.

The father refused to agree to amputation. The surgeon announced that there would probably be some improvement with tendon suture or tendon grafting. The father demanded to know which operation the surgeon proposed to recommend, and how much improvement could be expected with each. The surgeon refused to recommend either, or to prognose the improvement. If he accepted the case, he reserved the right to choose any operation according to circumstances, and reminded the father that he was not compelled to accept the case. He would operate if the father wished, but he would promise him nothing.

The father accepted the tactical defeat, and agreed to operation under the surgeon's terms. A tendon graft was eventually carried out with a moderately good result. The father brought an action against the school through whose window the child had originally thrust her hand. Without firm *pre-operative* approach to these matters his action might have been against the hospital, and against the surgeon.

The casualty officer faced with a patient who claims that his treatment has been negligent will not carry his explanations beyond a simple denial, and a reasoned (very short) discussion. If these are not accepted, the next move is with the patient.

CHAPTER XVI

LEGAL PROTECTION

VARIOUS references have already been made to occasions when the doctor's decisions have to take the legal situation into consideration as well as the clinical condition The casualty department is one where they arise with greater frequency than elsewhere, and as a result many younger medical men are becoming unwilling to accept appointments where they are more than usually vulnerable to legal proceedings. There has, in fact, been a notable increase in the number of occasions on which actions have been brought against medical practitioners. It is due to a combination of two changes in the Law which have come about in recent years:—

1. The Health Service Act of 1948, and the propaganda associated with its inception, which have tempted the ignorant to believe that they have a parliamentary right to be *cured*, when neither the Government nor any other human agency can establish the right to anything more than to be *treated*.

2. The Legal Aid and Advice Act of 1949, which established that under certain circumstances actions can be brought and their expenses covered from public funds.

Between these two many patients feel that they have little to lose, and much to gain, by maintaining that their treatment has been negligent.

An additional reason which affects the casualty officer is that many patients are quite willing to assail a public body such as a Hospital Management Committee, or a remote individual such as a hospital medical employee, where under similar circumstances they would refrain from action against their family doctor who may have rendered them or their near kin many admirable services in the past. The general practitioner is protected to some extent by the affection of his patients. It is very rare for anyone to develop a sentimental attachment to a hospital.

The casualty officer must therefore be aware of his particular vulnerability. If his defences are well arranged he need fear little, and his vulnerable position compared with that of his In-Patient colleagues need not deter him from choosing a casualty appointment if his taste lies in that direction. It is probable, indeed, that in future years *all* medical men will have to accept an increased liability to defend civil actions for negligence as a normal hazard of their professional life. An increase in frequency will mean a corresponding decrease in the possible damage to their reputations.

He will be on his guard against the litigiously-minded patient or relative. The type is comparatively easily detected and, in the majority of cases, easily dealt with. A few words before treatment is undertaken may avoid a

be carried in the head. An attempt to cast back in the memory while under cross-examination is almost invariably unsuccessful, and invariably unimpressive.

No recent change, nor any forseeable improvements in the future, alter the advisability that the medical employee should communicate with his Medical Defence Society. He will do this as soon as possible after any occurrence which he considers may render him liable to legal proceedings, without waiting for such proceedings to be initiated.

If a complaint is made about an act he never suspected could have given rise to it, his communication with the Society will be made before he makes any reply in writing to any of the interested parties. He must realise that, as soon as informal negotiations between the secretary of the Hospital Management Committee and the complainant have broken down, the Management Committee is still liable to consult only its own interests. It will consult them exclusively when they are opposed to his. The only body of experience and ability which will consult *his* exclusively is his own Defence Society. The Medical Defence Society should be informed of the full facts of the case, with as much detail as possible, at the earliest possible moment.

Case Histories

Case 1.—An intoxicated man attended a casualty department after he had been crushed by the wheel of a lorry. Compression of his chest from front to back and from side to side, and examination of the scalp, produced no clinical signs of injury. There were no signs of shock or pain. The patient was sent home in a taxi. He was admitted to another hospital the next day, and died soon afterwards. Post-mortem examination showed fractured ribs on both sides, a fractured collar bone, and congestion of the lungs. Heavy damages were awarded against the doctor and his employing authority, because he had not used a stethoscope. The Judge held that the casualty officer had not exercised reasonable care by not doing so, and that if he had done so the patient's condition would almost inevitably have been detected.

Negligence in a doctor is held to be shown if he fails to exercise that amount of skill which might be expected of him at his stage of experience and standing.

Case 2.—An anaesthetic was administered in a casualty department for attention to burns of the face and neck. It was started by a senior resident who used gas and oxygen inhalation. This proved unsatisfactory and the junior casualty officer (a female, five months qualified) reinforced it by giving 10 ml. of thiopentone (the weight of thiopentone is not stated). The patient died almost immediately. The Hospital Board and the junior casualty officer were sued jointly, and were held to have been negligent.

On trial of cross claims between the doctor and the Hospital Board, the Court apportioned the responsibility as 80 per cent. to the latter and 20 per cent. to the casualty officer. It found that the newly-qualified housewoman was not competent

Any communication he may receive from an aggrieved patient should be copied and the original sent to the Management Committee. At this stage it is advisable to await events because secretaries for Hospital Management Committees are developing a skill in advocacy which settles the majority of these affairs at this level. If the Management Committee requires a report from the casualty officer indicating that the matter is liable to be carried further, the casualty officer should communicate with his Defence Society before replying to the Management Committee, and should from that date be guided entirely by the Society's advice.

Up to the time a demand is made for a report to the Management Committee, the interests of the hospital officer and his employer are identical —both wish the matter to be dropped. Once all prospect of this is lost, there is a divergence of interest to some extent, because with the present state of the Law the hospital officer and the Management Committee may be sued jointly, but the latter may proceed (if losing the case) against the hospital officer as an individual, for the apportionment of responsibility. Alternatively, the Judge in the original action may himself apportion the blame between the two defending parties, and this apportionment can only be altered after a successful appeal. In 1949 the Ministry of Health instructed its Hospital Management Committees and similar bodies that, if they should be held liable for damages in a lawsuit, they should attempt to recover part or all of the sum from the doctor concerned, if this were possible. It is most unfortunate that it should be necessary to advise the medical employee to adopt a distrustful attitude towards his employing authority when their interests should be identical, and attempts are still being made to produce an improved atmosphere amongst the parties concerned in the defence of the case. Negotiations between the Ministry and the Joint Consultants and Specialists Committee of the B.M.A. have recently resulted in an agreement that such "cross-claims" shall *not* be initiated except in unusual circumstances. The details of this improved attitude of the Ministry towards its medical employees can be obtained from the secretaries of Hospital Management Committees. The negotiations have not, of course, changed the Law. Nor have they altered the advisability on the part of the house officer that he should look to *his own* defences from the very beginning. Thus any ill-advised confidences he may make to the Management Committee in the early stages, in the hope that its superior authority will rescue them both, may be revealed to his confusion later on.

He will therefore make a copy of the case notes, with any observations of his own, and keep it personally. This also must be done at the earliest opportunity, because the hospital notes belong to the Management Committee and it is possible (though unlikely) that he may be denied access to them as the case develops. It is emphasised that everything must be preserved in writing, and that dates and times of treatment and other events should be accurately recorded. These may be of great importance later and cannot

however, that he cannot rely on his employing authority to cover him from the effect of any possible errors.

Self-incriminating Evidence.—The preceding chapter has discussed occasions on which the casualty officer may be called upon to give evidence in Court, or to submit statements to the Police, when it is unlikely that any reflection will be cast upon his professional skill or his competence in handling the case. The preceding part of this chapter has been devoted to occasions when either one or other may be called in question, and when he is made aware of these attacks at an early date. Under these circumstances he may be in a position to anticipate them, to prepare his defence and to govern his behaviour accordingly.

It remains to discuss a further situation. Occasionally he may be faced with an altogether unexpected attack, in the course of giving evidence on an apparently straightforward case. It has been emphasised that by far the majority of his appearances in Court are so handled by the presiding authority that he is *assisted* in coming out of them with credit. By far the majority of questions put to him, which might be interpreted as showing a suspicion of his ability, are so put in order that he is given the opportunity to justify and indeed emphasise it (p. 248). If, by any mischance, he cannot answer without an imputation on himself, the Law entitles him to refuse to answer at all. The presiding authority, if appealed to, will advise him to refuse, and refuse he must.

He will, of course, resort to this course only when it is essential, for it may hold up further proceedings. Furthermore, it is tantamount to an admission that, at the least, he thinks it *possible* that he may have erred, and it may make the Court aware of something it has not suspected up to that time. It will also, almost inevitably, be reported in the Press. He must then at once communicate with his Defence Society and leave the rest to them.

It may be advisable that a similar course should be followed if any imputation is possible against the Management Committee or Board which employs him, or against another employee of one of these bodies. Under these circumstances he should announce that he considers his refusal to answer is a reserve on behalf of someone else, and if the Court directs that this attitude has no protection, he may then proceed to answer. If his refusal on behalf of someone else is sustained by the Court, he will communicate with the third party as well as with his own Defence Society.

Self-incriminating Evidence in the Coroner's Court.—The functions of the Coroner's Court were modified in March 1953, mainly after representations from the medical defence societies and the B.M.A. At the present time Coroner's inquests held on a dead body are designed to find out who the victim was, how, when and where he died; if the cause of death was murder, manslaughter, infanticide, or suicide; to determine who should be charged

to give thiopentone as an anaesthetic, and that the Hospital Board is required to provide someone to guide her in case of difficulty.

CASE 3.—A case of Dupuytren's contracture was operated upon by a whole-time medical officer. The post-operative care was largely in the hands of a house *surgeon and the nursing staff Following the post-operative treatment, the hand* was permanently crippled Each medical officer and the nursing sister brought evidence to show that as individuals they had not been guilty of negligence. The Court found that (although the hospital authorities would be responsible for the acts of the doctor and the house surgeon) there had been no negligence.

On appeal the finding was reversed The hospital authorities, in view of the terms of employment of the surgeon and of the house surgeon, were liable whether the negligence was that of the surgeon, or the house surgeon, or a member or members of the nursing staff. The Court of Appeal, therefore, finding that negligence *had* occurred, held the hospital entirely responsible for it.

CASE 4.—A casualty officer saw a patient who had been kicked in the abdomen by a horse nine and a half hours previously. A thorough examination was carried out, and no signs of intra-abdominal injury were detected. The case was sent home to the care of his own doctor, who was informed The doctor kept him under observation, and handed him over to the care of a locum when he went on holiday. Eighteen days after the accident the patient developed an intra-abdominal catastrophe, and was admitted. He died after an operation for gangrene and *recent* rupture of the caecum

Expert medical evidence was conflicting, and the Judge accepted the view of one expert witness who considered that certain signs "must have been present" at the casualty officer's examination. The Management Committee and the casualty officer were sued jointly. The Judge held that the casualty officer was responsible, and that he must bear the whole sum awarded as damages, and indemnify the Management Committee in respect of two-thirds of the costs.

This is probably the most controversial judicial finding in such a case since the inauguration of the Health Service. It is not sufficiently understood that the Judge is to choose between the evidence of the expert witnesses, and that there is no legal hiatus in the reasoning. The Medical Defence Union was advised that there was no hopeful ground for an appeal. Many medical men are of the opinion that the case was one in which surgeons of great experience might have failed to diagnose an intra-abdominal lesion at the first examination. The Judge accepted the evidence of one expert witness that a doctor of average skill could have diagnosed the condition and would have operated at once or arranged for operation. There appears to be support among surgeons for the views of another expert witness, who spoke of the possibility of a new, intervening condition.

These four cases illustrate various findings on apportionment of responsibility between the casualty officer and his employers, from an occasion when he may be exonerated from all civil responsibility, to one when he must shoulder the whole of it. To the casualty officer himself it may appear that very different results can arise from very similar situations. They all illustrate,

The procedure to be adopted by a casualty officer if asked to give evidence or make a statement to any such committees as may already have been set up is much the same as if the information had been asked by his employing authority itself.

1. He will make a precise record of all the pertinent clinical and other facts, with dates and times where indicated. He will copy as much of the contents of the case papers as he is likely to require, as soon as possible, in the very unlikely event of their being impounded. He will keep these records and copies personally.

2. He will cooperate in any *informal* efforts which may be made to settle any complaint or dispute.

3. If he is called to any enquiry held by such a committee, and if, in his view, there is any likelihood of his own behaviour suffering criticism, he will communicate with his Defence Society *before* submitting any statement or attending any meeting. If the standing committee calls him to a meeting before he has had the opportunity to do so, he will not give any evidence which might compromise himself, nor any in defence of his behaviour.

This attitude is only likely to be necessary if the standing committee exceeds its functions, which have been indicated above, and which have been defined by the Regional Boards concerned. It may be that the Regional Boards *mean* these committees to confine their inquiries to the defects in hospital organisation. Unfortunately some such committees may perhaps go beyond their mandate in the interests of the case, and the junior hospital officer is in no position to call the Chairman to order. He must not, however, give any opportunity for his own actions to be put on record until he has had proper legal advice.

* * * * *

It might appear from the discussions in this chapter, and from the alarming nature of the case histories, that the casualty officer's duty is fraught with professional and financial peril. It has been admitted at the beginning of the chapter that litigation against casualty officers has shown a significant increase in the last five or six years.

This increase has not gone unnoticed, and the profession is devising methods to control it if possible, and to mitigate it if not. In particular, attempts to restore the *rapport* between the doctor and his employing authority are being prosecuted with vigour, and there is much to show that the efforts are coming from the Ministry as well as the profession.

Secondly, it is believed by medico-legal experts that the present position is a transitional one, and many believe that if the doctor can be held entirely responsible for his actions, as in Scotland[1] his responsibility toward his patients

[1]A recent finding in a Scottish court suggests that the *Scottish* attitude to this point may come into line with the *English*.

as author of or accessory to the crime if there is one—and to establish particulars required by the Registrar-General.

Neither the Coroner nor his jury is to express an opinion on anything else, but they may make recommendations designed to prevent a recurrence of similar fatalities.

These changes virtually abolish the " rider " to the verdict. No verdict is to be framed in such a way as to appear to determine any question of civil liability.

If the doctor is asked questions at an inquest which appear to him to go beyond the objects already defined (that is, if they appear to put him in danger of admitting a liability, rather than to give him the opportunity of denying it; or if he considers that a question is put merely for the purpose of establishing civil liability as distinct from the cause of death) he is in the same position as he would be in any other Court, and he should refuse to answer. He has additional support in the fact that any such questions go beyond the function of the Coroner's Court, and that a refusal on this occasion cannot be construed as an expression of his own disquiet. Any civil proceedings must be brought by separate action in another Court. The delay will give him an opportunity to communicate with his Defence Society, to consider his answer with care, and if necessary to prepare his case. It ought not to be overlooked that an astute advocate may seek to use the evidence given at a Coroner's inquest to establish civil liability in subsequent negotiations or proceedings; though usually Coroners are alive to this and will limit the evidence accordingly. If perchance the Coroner does not intervene, it is quite legitimate for the doctor to raise objection and leave it to the Coroner to decide whether the question is a proper one in the whole of the circumstances.

A similar situation may arise, and does so not infrequently, where the treatment and reputation of another doctor (who may or may not be present) are in issue. It is hardly necessary to point out that the casualty officer should tread warily.

Standing Committees Set Up by the Hospital Management Committees.—Certain Regional Boards are in process of setting up, or are advising Hospital Management Committees to set up, a standing committee composed of medical or medical and lay men, whose function is to investigate occurrences in the treatment of patients which reveal administrative weaknesses. The occurrences will be, for the most part, deaths or " misfortunes of treatment," and the avowed intent of these committees is to find faults in hospital organisation, and to decide how similar faults may be avoided in the future.

It is maintained that there is no intention to establish blameworthiness or liability for damage, no intention to prejudge the case, and no danger that such investigations will attempt to detract from the Coroner's responsibility where a death is the subject of investigation.

CONCLUSION

IN one sense there cannot be a conclusion. Minor surgery progresses, and the casualty surgeon's work advances, because no surgery is static. In a new Health Service the administrative aspects, and the casualty surgeon's place in the hospital pattern, are altering also. The responsibilities of the casualty department are increasing. Its opportunities for completing treatment are greater than they were, and they will be greater still.

The changing relationship between antibiotics and the organisms susceptible to them is a case in point. What may be advisable in 1954 may fail to fit the situation in 1960. The casualty department wages modern warfare, in which mobile weapons aim at mobile targets.

It has been said that a medical book is out of date by the time it is published, and doubtless this book is no exception. Because it deals with many matters on which views are changing it may be more rapidly out-dated than most. If some of its details are left behind, the principles may remain on which to elaborate other methods. If it emphasises that these changes are occurring, indicates how they can be detected, and how profit can best be drawn from any future advances which may be made in other fields; if it reminds its readers that the casualty department need not be a backwater in which the use of some up-to-date preparation is tacked on to time-worn methods and inherited ideas, it will have served its purpose.

The casualty department displays a cross section of the body of modern medicine. Infinite variety is revealed therein, and infinite scope for enterprise.

will be strengthened and the support of his employers is more likely to be enlisted.

Thirdly, improvement in the status of the casualty officer, a fuller appreciation of the importance of his work, and a greater respect for his professional and legal responsibilities, are increasing the interest of his seniors and making it easier for him to call upon their advice and support. These will remove the feeling that he is left rather alone in the hospital world, with nowhere to look for assistance.

Finally, in spite of the undoubted increase in the incidence of such events as have been reported in this chapter, they remain comparatively rare. One hundred thousand cases have passed through the casualty department in the period of work covered by this book. Seventeen housemen have been concerned. The author has no knowledge of proceedings against any casualty officer of his acquaintance, either in this time or the ten years before it. Many of his colleagues could say the same. The chances of any one casualty officer being called upon to defend a suit during his term of office are very small. The chances of his losing the case are very much smaller. If he brings average conscientiousness to his work, and combines it with a certain wariness, the slight remaining risk need not deter the faintest heart.

REFERENCES

Cases quoted on pp. 261-262
Case 1 (1951) *Brit. med. J.* ii, 616
Case 2 [illegible]
Case 3. [illegible]
Case 4 [illegible]

See also,
BANKS, A L., HISLOP, J. A (1954) " Negligence "
Lancet, i, 1337

APPENDIX II

Bacteriological Reports, 1953

Table I

Fresh, unruptured lesions, 56 cases.

	Gram negative bacilli	*Penicillin sensitive staph. aureus*	*Penicillin sensitive staph. aureus and haemolytic streptococcus*	*Penicillin resistant staph. aureus*
Paronychia	1	13	1	—
Subcutaneous abscesses	1[1]	24	3	1
Breast abscess (infant delivered at home)	—	2	—	—
Hair follicle infection	—	10	—	—

Penicillin insensitivity about 5 per cent.
[1] See p. 95.

Seven reports on breast abscess are not included. The patients were delivered in hospital and five out of seven were penicillin insensitive (see p. 273).

Table II

Discharging lesions, 46 cases.

	Gram negative bacilli	*Penicillin sensitive staph. aureus*	*Penicillin sensitive staph. aureus and haemolytic streptococcus*	*Penicillin resistant staph. aureus*
Paronychia	1	12	4	2
Subcutaneous abscesses	—	7	4	4
Hair follicle infection	—	3[1]	—	1
Granulating wounds	—	5	—	3

the year reported as *chloramphenicol*

APPENDIX I

Analysis of Three Thousand Consecutive Cases attending the Casualty Department, with Classified Reasons for Their Attendance

One Attendance Only

	%
For reference to other departments, including the disposal of emergencies	14
For "X-rays to eliminate"—these were all negative results . . .	6
For conditions referable to own doctor after preliminary treatment .	4
For conditions requiring one treatment only—splinters, abrasions, superficial foreign bodies, reassurance, etc.	18
Unclassified . . . . less than	1
Total .	42

More than One Attendance

Lacerated wounds	20
Staphylococcal or streptococcal infections	18
Other infections	2
Minor burns and scalds	1
Cysts, other clean excisions, prompt exploration for deeper foreign bodies, etc.	2
Sprains, strains, contusions, abrasions, etc.	14
Unclassified . . . . less than	1
Total .	58

APPENDIX III

ANALYSIS OF SEPTIC HAND CASES 1948-1953 INCLUSIVE

	1948	1949	1950	1951	1952	1953
Paronychia No. of cases	252	229	221	257	300	230
Disability	15	14	14	11	8	6
Pulp space No. of cases	164	152	168	228	232	217
Disability	28	25	16	11¼	10	9
Subcutaneous No. of cases	244	228	181	277	308	237
Disability	19	14	14	12	9	8½
Cellulitis and lymphangitis No. of cases	56	25	23	42	42	38
Disability	10½	10	7½	6	6	5
Primary tendon sheath infection No. of cases	—	—	3	4	5	7
Disability	—	—	57	14	9	13[1]
Hand cases records available	923	808	991	1032	1086	907
Cases completing treatment	770[2]	695[2]	744[2]	908[2]	976[2]	796[2]

The year in which [illegible] classes of septic hands [illegible]

[1] Th[illegible] [illegible]tment.

[2] Th[illegible], and other conditions which have shown no marked alteration in average incapacities and which are not included in the detailed analysis.

TABLE III

30 consecutive cases ("The Bacteriological Survey," p. 10)

	Gram negative bacilli	*Penicillin sensitive staph. aureus*	*Penicillin sensitive staph. aureus and haemolytic streptococcus*	*Penicillin resistant staph. aureus*
Paronychia	1	5	1	—
Subcutaneous abscesses (unruptured)	—	15	—	—
Subcutaneous abscesses (ruptured)	—	—	—	1[1]
Hair follicle infection (unruptured)	—	4	—	—
Hair follicle infection (ruptured)	—	—	—	1[1]
Granulating wounds	—	2	—	—

[1] [illegible] "slightly sensitive only"

APPENDIX IV

NOTES ON A "PILOT INVESTIGATION" TO ASCERTAIN IF THE ROUTINE TREATMENT OF ACUTE BREAST ABSCESS IN THE OUT-PATIENT DEPARTMENT IS A PRACTICAL PROPOSITION

CONTROL ANALYSIS of thirty-six cases of breast abscess treated in 1948.

All cases were admitted as In-Patients for the first stage of treatment.

Twenty-seven cases were discharged, treated for varying periods after discharge in the Out-Patient Department, and ultimately dismissed, *unhealed*, to the care of the family doctor or the district nurse. The average length of In-Patient treatment was five days. The average length of hospital treatment (In-Patient and Out-Patient) was twenty-one days. The length of treatment by the district nurse could not be estimated, nor, therefore, could the healing time.

Eight cases were dismissed to the care of their family doctor, with no record of whether they were healed or not. The average length of hospital treatment was twelve days.

One case was dismissed, healed, on the fourteenth day.

ANALYSIS of twenty-eight cases of breast abscess treated between June and December, 1953.

Twenty-five cases were treated entirely as Out-Patients.

One case was admitted for three days because of pyrexia.

One case was admitted because the differential diagnosis from carcinoma was not clear at first sight.

One case was admitted because of severe toxaemia. This case was a mental defective and defaulted on treatment. It is not included in the further analysis.

The other two In-Patient cases are included.

All cases were dry and healed before dismissal.

Twenty-seven cases averaged eight and a half days' treatment.

Four cases (included in the above) in non-lactating breasts, averaged six days.

Three cases maintained breast feeding throughout.

In twenty-five cases primary suture with cavity obliteration was carried out.

In ten cases the pus was cultured. One grew nothing. Four cases (two delivered at home, two in hospital) grew penicillin sensitive staphylococcus aureus. Five cases (delivered in hospital) grew *penicillin resistant staphylococcus aureus*.

(It is accepted that a continuation of Out-Patient treatment as a routine is worthy of a more extended trial. More bacteriological information is necessary before any principles can be established.)

SUPPURATIVE ARTHRITIS.

1948. Two cases secondary to paronychia.

1949. Three cases secondary to dorsal infection, one in a chronic arthritic.

1950. Two cases secondary to penetrating wounds.

1951. One case, cause not noted.

1952. Three cases One, due to extensive subcutaneous infection, came to amputation. Two, due to dorsal infection, both in chronic arthritics, with recovery.

1953 Four cases. One due to a penetrating wound, came to amputation. One due to dorsal infection in a chronic arthritic, with recovery. Two due to extensive subcutaneous infection, with recovery.

SECONDARY TENDON SHEATH INFECTION.

1948. None recorded.

1949. One case, from volar compartment abscess.

1950. One case, from web space infection.

1951. Two cases, from volar compartment abscess.

1952. Three cases, from volar compartment abscess.

1953. Five cases, from volar compartment abscess. The increase in "incidence" in this condition is probably due to increased accuracy in diagnosis.

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(The figures in bold type refer to titles of sections)